MAR 23 1942

The Physiotherapy Review

Volume 22 Number 2

Table of Contents

	Page
Some Observations of Muscle Function: With Special Reference to Pluriarticular Muscles—Signe Brunnstrom	67
Physical Therapy as a Vocation—Ida May Hazenhyer, M. A.	76
How to Relax	82
Synchronizing Biplane Stance Photography with Center of Gravity Observations—F. A. Hellebrandt and L. E. A. Kelso	83
The Influence of Postural Sway on Stance Photography —F. A. Hellebrandt, Kathryn S. Riddle and E. Corinne Fries	88
Simple Workable Respirator	96
Vapor Bath Apparatus: Invented by Dr. Louis H. Lefebvre—William Dosité Postell, B.S., M.S., B.S., in L.S.	97
Editorials, Conference Program and News	100
Index to Current Literature	104
Abstracts—John S. Coulter, M. D.	107
Book Reviews	121
Convention Calendar	124
Chapter Directory	125

Published Bi-Monthly By
THE AMERICAN PHYSIOTHERAPY ASSOCIATION
MARCH-APRIL, 1942

The American Physiotherapy Association

Executive Committee

PRESIDENT

CATHERINE WORTHINGHAM.....Stanford University, Calif.

VICE-PRESIDENTS

DOROTHY YOUNG.....480 Menlo Oaks Dr., Menlo Park, Calif.
BETTY A. RICE.....5160 Claremont, Oakland, Calif.

SECRETARY

EVELYN ANDERSON.....5 Rico Way, San Francisco, Calif.

TREASURER

ALICE V. GANTZER.....245 Vicksburg St., San Francisco, Calif.

DIRECTORS

GERTRUDE BEARD.....303 E. Chicago Ave., Chicago, Ill.
CONSTANCE K. GREENE....105 South Huntington Ave., Boston, Mass.
MARGUERITE IRVINE.....1011 Summitt Ave., Seattle, Wash.
HELEN L. KAISER.....1800 E. 105th St., Cleveland, O.
SARA KOLLMAN.....500 Harvard St., S. E., Minneapolis, Minn.
ALICE LOU PLASTRIDGE....Warm Springs Foundation, Warm Springs, Ga.

Standing Committees

COMMITTEE ON EDUCATION

JANET B. MERRILL.....
.....Children's Hospital, Boston, Mass.

COMMITTEE ON LEGISLATION

CECILIA A. LEVERONE.....
.....668 Washington St., Brighton, Mass.

COMMITTEE ON MEMBERSHIP

BETTY A. RICE, 5160 Claremont, Oakland, Calif.

COMMITTEE ON RELATIONS

HAZEL FURSCOTT .....
....219 Fitzhugh Bldg., San Francisco, Calif.
MRS. HARRIET S. LEE.....
.....1201 Race St., Denver, Colo.

Subcommittees

Exhibits

MRS. MARGARET WINTERS.....
.....950 E. 59th St., Chicago, Ill.

Advisory Board, American Registry of Physical Therapy Technicians

HELEN L. KAISER.....
.....1800 East 105th St., Cleveland, Ohio

Advisory Board, "The Crippled Child" Magazine

EMMY KYLIN .....
.....409 Prospect Road, Ashtabula, Ohio

Advisory Committee on Services for Crippled Children

MILDRED ELSON .....
.....737 N. Michigan Ave., Chicago, Ill.

National Organization for Public Health Nursing

Appointment pending. Address all correspondence to American Physiotherapy Association, Stanford University, Calif.

Advisory Committee

FREDERIC C. BOST, M. D. .....
.....384 Post St., San Francisco, Calif.
JOHN S. COULTER, M. D.
.....303 E. Chicago Ave., Chicago, Ill.
PHILIP K. GILMAN, M. D.....
....2000 Van Ness Ave., San Francisco, Calif.
HOWARD C. NAFFZIGER, M. D.....
.....University of California
Medical School, San Francisco, Calif.
RAY LYMAN WILBUR, M. D.....
.....Stanford University, Calif.

Office of Publication, 1600 N. Main St., Pontiac, Illinois.
Executive and Editorial Office, 737 North Michigan Ave., Chicago, Ill.

Membership in The American Physiotherapy Association is $3.00 a year, including a subscription to THE PHYSIOTHERAPY REVIEW. Subscription for non-members to THE PHYSIOTHERAPY REVIEW $2.50 a year; $2.80 in Canada and foreign countries. Single copies 35 cents to members; 50 cents to nonmembers. Entered at the post office at Pontiac, Ill. as second class matter.

The Physiotherapy Review

Published Bi-Monthly by The American Physiotherapy Association

Volume 22 March-April Number 2

Some Observations of Muscle Function:

With Special Reference to Pluriarticular Muscles

Signe Brunnstrom

Before discussing the behavior of pluriarticular muscles a few points on muscle function in general will be reviewed.

There are three main types of muscular contractions carried out by skeletal muscles:

1. Concentric contraction (shortening contraction)—the distance between origin and insertion decreases. Example: a person rises to a standing position from a sitting position; there is a shortening contraction of the hip extensors and the knee extensors.
2. Eccentric contraction (lengthening contraction)—the distance between origin and insertion increases. Example: from the standing position a person assumes the sitting position; there is a lengthening contraction of the extensors of the hip and the extensors of the knee.
3 Static contraction (holding contraction)—the distance between origin and insertion remains unchanged. Examples: (a) maintaining the arm abducted in the standing position; the abductors of the arm and the upward rotators of the scapula contract statically; (b) holding an object firmly in the hand, such as a tennis racket; the flexors of the fingers and the dorsal flexors of the hand contract statically.

The first type of contraction occurs whenever the body as a whole or one of its parts moves against the pull of gravity or some other opposing force (object lifted, friction overcome, machinery set in motion, resistance by another person, resistance by antagonistic muscles, etc.). When a muscle shortens it will move its point of origin and its point of insertion toward the center of its belly (implied in the word "concentric"), provided there is no fixation at either end. Should one end be stabilized or offer considerable resistance to the motion, then, obviously, that part which offers less resistance will move. In some motions the origin is stable and the insertion moves; in others the reverse is true. The tibialis anterior is said to originate on the tibia and insert into the first cuneiform and the first metatarsal bone. When the tibia is stabilized this muscle moves the foot in relation to the leg. However, just as frequently the foot is stabilized, as when there is weight bearing on the foot, and the tibialis anterior in this case moves the leg in relation to the foot, assisting in maintaining balance at the ankle joint. In the same manner, the soleus may plantar flex the foot in relation to the leg or balance the leg on the foot; the thigh extensors may extend the thigh in relation to the pelvis or the pelvis in relation to the thigh; the scalenei muscles may move the cervical spine in relation to the rib cage or may pull the upper ribs toward the cervical spine.

In the second type of contraction (eccentric) an outside force (gravity, machinery, other person, etc.) causes the movement while the muscle regulates the speed. The action of the

10 East 9th Street, New York, N. Y.

muscle here may be compared to the brakes on a car.

The third type of contraction (static) is used for stabilization purposes, that is, to hold a part of the body or an object in a desired position. When dealing with pluriarticular muscles one frequently encounters this type of contraction, since it often is necessary to stabilize one joint over which a muscle passes to enable it to act on a further one. For example, when making a fist, the extensors of the wrist must contract to prevent the finger flexors from palmar flexing the hand. Maintaining the wrist stable in a dorsiflexed position enhances the action of the finger flexors and a firm grip is obtained.

The guiding action of muscles. By the guiding action of muscles is meant that muscles other than those actually performing the motion may come into action to bring about the desired direction. For instance, when the gastrocnemius and the soleus plantar flex the foot, the tibialis posterior and the peroneus longus guide the motion in regard to inversion-eversion. Very often this guiding action is taken care of by the same muscles which perform the movement. In flexion of the thigh on the pelvis the sartorius outward-rotates as it flexes, while the tensor fasciae latae flexes and inward-rotates. By changing the relationship of contraction of these two muscles the desired degree of outward-inward rotation is obtained.

The balancing action of muscles. By the balancing action of muscles around weight-bearing joints is meant the coordinated action of all muscles surrounding the joint. It is a give-and-take action, consisting of minute concentric and eccentric contractions, as the occasion demands. These muscles are in a state of readiness and either will prevent a disturbance of balance, or, once a disturbance has occurred, they will act to restore the balance. Static contraction of balancing muscles in most instances should be avoided, since such contraction would serve no useful purpose.

PLURIARTICULAR MUSCLES

A pluriarticular muscle when called into activity behaves essentially in the same manner as a monarticular muscle: it may contract concentrically, eccentrically or statically; it may move origin in relation to insertion or vice versa; it may display a guiding or balancing action, and so on. However, the possibilities for varied action increase in direct proportion to the number of joints a muscle passes. A three-joint muscle, for instance, may, at least theoretically, act on all three joints simultaneously, on each joint separately, or on two joints out of three in various combinations. It does not arbitrarily pick out one joint on which to act, but there is always a definite reason for its behavior.

When studying the action of pluriarticular muscles it is suggested that the following points be considered:

1. Fixation.
2. Angle of pull at each joint.
3. Change in tension in a muscle during contraction—amount of useful shortening of which a muscle is capable.
4. Amount of lengthening of which a muscle is capable.

Fixation

A pluriarticular muscle will produce movement at the joint which offers least resistance. If one joint has a firm fixation, then, obviously, the movement will take place in the other joint or joints. It cannot always be stated definitely that a pluriarticular muscle has its primary action on one joint and its secondary action on another. For example, it seems useless to discuss what would be the primary and what the secondary action of the biceps brachii, a subject which has caused much controversy in the past. This muscle passes the shoulder joint, the elbow joint and the radio-ulnar joint and it may act on either. In the movement of chinning, with the hands grasping a firm bar, the biceps cannot act as a supinator, and it becomes a powerful elbow flexor; when a screw driver is being used, the contraction of the triceps, necessary for pushing the screw in, also prevents the biceps from flexing the elbow, consequently its action is supination only; when a person makes a handstand with weight bearing through an extended elbow, the biceps cannot act as a flexor, and its action as a supinator is very limited; hence, its action, if any, will be on the shoulder joint.

Angle of pull

In certain positions the angle of pull of a muscle on its lever may be so small as to make it impossible for the muscle to initiate a movement. Once the "dead point" has been overcome, the angle of pull increases, and the muscle can be used to greater advantage. Two examples will illustrate:

The flexor pollicis brevis, as its name indicates, is a flexor of the thumb, performing flexion at the metacarpophalangeal joint. However, its

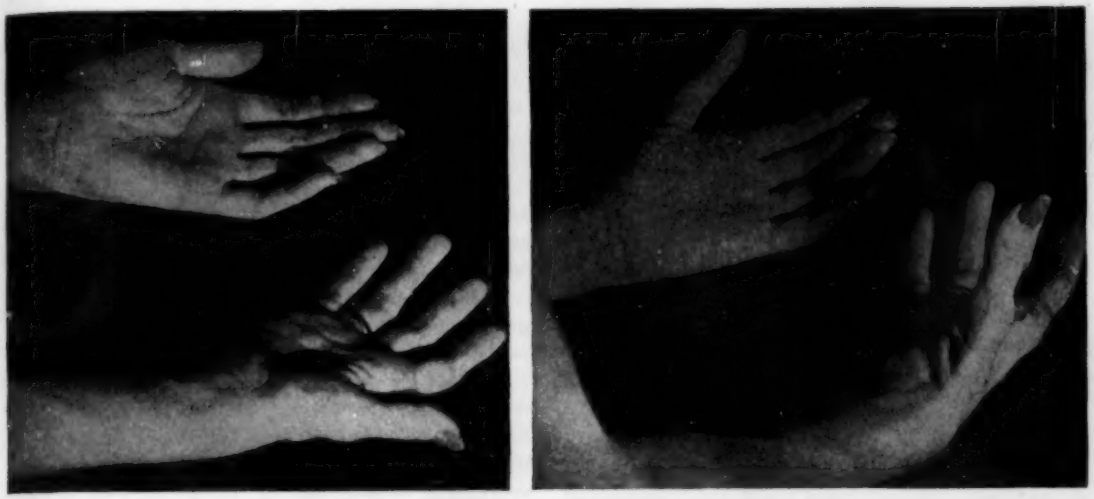


FIGURE 1

A. Paralysis of right opponens pollicis. Subject unable to oppose thumb.

B. After thumb has been placed in opposition it is held there by flexor pollicis brevis.

anatomical position is such as to enable it to act on the carpometacarpal joint of the thumb as well, assisting the opponens pollicis in its action of opposition of the first metacarpal bone. A subject with opponens paralysis was unable to initiate the movement of opposition, but after the thumb had been placed in opposition it could be maintained there by the flexor pollicis brevis (Fig. 1). In the first position the angle of pull of the flexor pollicis brevis for opposition was very poor. In the second position the "dead point" had been overcome and the angle of pull was favorable.

The psoas muscle, when the hip joint is extended, has an extremely poor angle of pull on the femur. According to Krukenberg (quoting von Meyer and Hyrtl)[1], this muscle, even when of normal strength, is unable to initiate flexion of the thigh. It passes in front of the capsular ligament of the hip joint and lies very close to the axis of motion of this joint. In the erect standing position, therefore, the psoas major exerts a pressure on the hip joint anteriorly without causing any flexion. By its pull upward on the lesser trochanter it maintains firm contact between the head of the femur and the acetabulum, thus stabilizing the hip joint. In this position, the poor angle of pull excludes action on the hip joint and enhances action on the spinal column. On the other hand, after flexion of the thigh has been initiated the psoas major has a better angle of pull on the femur, and increasingly so with increased thigh flexion. It can then be used with advantage for flexion of the thigh on the pelvis or the pelvis on the thigh. This arrangement is a marvelously economical device. One and the same muscle is doing triple duty: it balances the spinal column on the pelvis; it stabilizes the hip joint; and, at other times, it serves as a powerful flexor of the hip joint.

Change in tension in a muscle during contraction —amount of useful shortening of which a muscle is capable

A muscle, when contracting, has the ability to overcome resistance, that is, to perform work, as long as it possesses sufficient tension. "The tension of a muscle . . . . is continually decreasing during contraction. It is at a maximum at the beginning and gradually decreases."[2] Although "a muscle may have an extreme actual shortening of about 80 per cent of its length when the tendon of insertion is cut,"[2] its tension decreases so rapidly during contraction that only a small percentage of its potential shortening can be translated into useful movement. For all practical purposes one can state therefore that a muscle is capable of shortening a relatively small distance (much less that 80 per cent), and that, after this shortening has occurred, the muscle is unable to bring about further movement of the part. The amount of useful shortening of which a muscle is capable varies in accordance with the muscle's shape and structure, and it depends to a certain extent upon training, but for each muscle

it is fairly constant.

This explains why a pluriarticular muscle may be unable to carry out a complete movement when the various joints over which it passes are allowed to move in the same direction. For example:

1. When the wrist is held in extreme palmar flexion one is unable to close the fingers completely and the grip is very weak. In this position the origin and the insertion of the finger flexors are already considerably approximated and the muscles cannot do much useful work. The tension of the finger extensors, which are put on a stretch both at the wrist and at the finger joints, also impedes the motion. On the other hand, when the wrist is held in dorsal flexion, the finger flexors are put on a stretch, which enhances their action, and the tension of the finger extensors is avoided.
2. In flexion of the thigh on the trunk most of the thigh flexors have reached their maximum useful shortening when the thigh has been flexed to 90 degrees. Beyond this point the iliopsoas muscle, which has a remarkable shortening ability, carries out the movement unaided by the other flexors. If the lumbar spine, from where the psoas originates, is allowed to move forward into a lordotic position when flexion beyond 90 degrees is performed, the movement is hindered. By maintaining the lumbar spine firm, flexion of the thigh is facilitated and can be carried out a few degrees further. Bringing the lumbar spine into a kyphotic position further enhances flexion of the thigh. (Note this tendency when an attempt is made to bring the knee up to touch the chest in either sitting or standing position.)

Amount of lengthening of which a muscle is capable

The extensor digitorum communis, when put on a stretch over the wrist joint and the metacarpophalangeal joints simultaneouly, soon reaches its maximum elongation. Hence, it opposes finger flexion (see above). Conversely, the finger flexors oppose finger extension if the wrist is held in complete dorsal flexion.

A similar condition is brought about in the hamstrings if leg extension is attempted while the hip is fully flexed. Even a moderate amount of flexion of the thigh (90 degrees) renders leg extension more difficult. A weak quadriceps therefore should not be tested or trained in this position. Instead of having the patient sitting erect, he should be allowed to lean backward or to assume the backlying position with bent knees.

PLURIARTICULAR MUSCLES OF HIP, KNEE AND ANKLE

Hip and knee

Muscles which cross both hip and knee joints are: sartorius, rectus femoris, semitendinosus, semimembranosus, and the long head of the biceps femoris.

The sartorius muscle with its origin on the anterior superior spine of the ilium has at all times a good angle of pull for action on the hip joint. Even when the hip joint is fully extended it lies sufficiently away from the center of motion of this joint to secure action. It can be used therefore to initiate flexion of the thigh, a movement which cannot be performed by the iliopsoas. Its action on the knee is less important, since it passes only slightly behind the center of motion of the knee joint when the knee is extended. As the knee is being flexed the angle of pull of the sartorius tendon on the leg increases. It would seem therefore as if the motions of thigh flexion and knee flexion would tend to occur together after the first few degrees of flexion have been overcome.

To study the action of the sartorius, make the following experiment: A subject who is standing with the back to the wall is asked to pull one knee up while leaving the lower leg hanging loose. ("Feel the foot and the leg heavy, as a dead weight.") This is not a difficult coordination for the average person. As the knee is pulled up all the flexors of the thigh come into action, including the sartorius and the rectus femoris. Palpate for tension in these muscles. The sartorius will tend to flex the knee while the rectus will tend to extend it. The action of one neutralizes the action of the other, and the lower leg will hang in a vertical position. (It is here taken for granted that the subject is able to keep the hamstring muscles relaxed.) A certain tension around the knee joint, however, cannot be avoided, since an antagonistic action between the rectus and the sartorius in regard to the knee joint definitely exists. This tension can be demonstrated easily in the following way: The subject, standing as before, maintains the thigh flexed and the lower leg hanging relaxed. The examiner then starts a pendulum motion of the lower leg by giving it an initial

push while the subject remains as inactive as possible. It will be observed that the pendulum movement decreases in amplitude very rapidly and that the leg stops in a vertical position after a few swinging motions. To contrast this motion with a true pendulum movement the examiner now supports the thigh in a flexed position, carrying the whole weight of the subject's lower extremity, so that the flexors of the thigh can relax. A movement of the lower leg initiated by the examiner under these circumstances proves a true pendulum movement. It decreases in amplitude more slowly, and the leg continues swinging in smaller and smaller motions until it finally stops in the vertical position. In order to bring about a true pendulum movement in the first instance, the subject would have to learn to relax the sartorius and the rectus while contracting the remaining flexors of the thigh, a coordination which is contrary to established neuromuscular patterns. To discuss whether or not such a coordination could be learned lies outside of the scope of this paper.

A study of the hamstrings and their relation to the flexors of the thigh and to the extensors of the leg furnishes typical examples of the complex action of pluriarticular muscles.

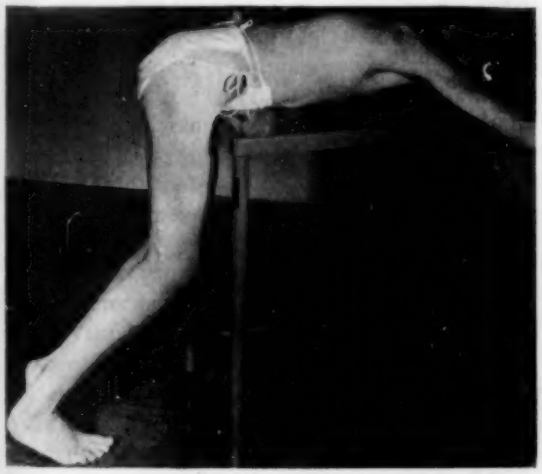


Figure 2. Starting position for testing flexion of leg. To stabilize position, examiner should give support under unaffected knee.

It has already been pointed out that the average individual is unable to perform leg extension when the thigh is completely flexed. In such position the hamstrings are put on a stretch both from above and from below, and they reach their maximum elongation before the knee is completely straight. Conversely, it is impossible to perform full leg flexion while keeping the hip joint extended. This is probably due mainly to the inability of the rectus femoris to elongate sufficiently, but it may also indicate that the hamstrings have reached their maximum useful shortening before the motion is completed.

In purposeful movement the combination of extreme thigh extension and flexion of the leg, or of complete thigh flexion and leg extension, very seldom, if ever, occurs. The natural combination is rather hip-knee flexion and hip-knee

Figure 3. Starting position for flexion of leg. "Dead point" has been overcome.

extension. The strength of leg flexion increases tremendously if the thigh is allowed to flex simultaneously. Likewise, leg extension is stronger if combined with thigh extension.

Since thigh extension makes leg flexion less efficient even in normal subjects, one must take care not to use this combination when dealing with weak muscles. For instance, when leg flexion against gravity is tested, particularly if a wide range of motion is desired, the subject should not assume the ordinary prone-lying position but should be lying prone over the edge of the table with flexion at the hip and a small amount of flexion at the knee (Fig. 2). If only a very small range of motion is desired, the ordinary prone-lying position may be used (Fig. 3). In both instances, the knees are slightly flexed in the starting position. This latter precaution is of greatest importance. When the knee joint is fully extended, and more so when it is hyperextended, the hamstrings have a very poor angle of pull on the leg. Weak hamstrings may be unable in this position to initiate the movement of leg flexion, and the false conclusion may be drawn that these muscles cannot work against gravity. Figure 4 illustrates this condition. The subject was unable to start the movement, but once a more favorable angle of pull was secured for the hamstrings, these muscles would work against gravity and slight resistance by the examiner.

As a general rule it has been stated that a

Figure 4. Hamstring weakness of right leg. Subject is unable to initiate flexion of the leg against gravity. After the motion has been started by the examiner, flexion can be performed against gravity and slight resistance. The angle of pull of the hamstrings is very poor when the knee is extended, and the "dead point" cannot be overcome. Note also that there is a paralysis of the gastrocnemius.

contracting muscle will tend to move both origin and insertion, if there is no fixation at either end. When the hamstrings contract they would tend therefore to extend the thigh while flexing the leg, a movement which is contrary to the "natural" combination mentioned above. The reason why they seldom do so may be found if one considers that : (1) one end of the muscle usually is stabilized; (2) in certain positions the angle of pull is favorable at the point of origin, in other positions it is favorable at the point of insertion. In the upright standing position, for instance, the knee joint is stabilized by the superimposed body weight and the angle of pull of the hamstrings at the knee is very small; hence, the action of the hamstrings will be transferred to the pelvis which is less stable than the legs. Thus, in the standing position, the hamstrings exercise a balancing action on the pelvis, preventing it from tilting forward. On the other hand, when the thigh and the leg are flexed simultaneously, as in the non-weight-bearing phase of walking, running and climbing stairs, the condition is reversed. The thigh flexors by their contraction prevent the hamstrings from acting on the hip, and the hamstrings therefore will act on the leg.

Knee and Ankle

The gastrocnemius muscle, originating above the knee joint and inserting into the calcaneus, may act either as a flexor of the leg or as a plantar flexor of the foot, depending upon which joint is stabilized, or it may act on both joints simultaneously if there is no fixation at either joint.

Fixation. In the standing position, when the knees are straight, the weight from above, transferred through the knee joints, will give fixation at this joint, and the gastrocnemius, when contracting, will act on the ankle joint. In order to make a knee flexor out of the gastrocnemius one must secure fixation of the ankle joint. Its action on the knee can be observed in subjects with weakness or paralysis of the hamstrings, in which case an attempt is made to use the gastrocnemius for knee flexion. Such a subject, when lying prone and asked to flex the leg, holds the ankle rigid in a slightly dorsiflexed position, thereby attempting to transfer the action of the gastrocnemius to the knee joint. Flexion of the knee by the gastrocnemius is a very uneconomical motion. Much energy is consumed by the dorsal flexors of the foot, antagonizing the gastrocnemius at the ankle, and a poor result is obtained at the knee.

Angle of pull. The gastrocnemius, at all times, has a better angle of pull on the calcaneous than on the femur, making it a strong plantar flexor of the foot and a weak knee flexor. However, its support of the knee joint posteriorly is important for protection of this joint. In many daily activities, such as the pushing off phase of walking, running and jumping, involving cocontraction of the quadriceps and the gastrocnemius, this latter muscle has the double function of plantar flexing the foot and of preventing the quadriceps from hyperextending the knee. The extension of the knee by the quadriceps at the same time enhances the action of the gastrocnemius by giving it a stable point from which to pull. The expression "team work among muscles" is here well illustrated.

Maximum useful shortening of the gastrocnemius occurs when the knee is held in complete flexion while plantar flexion of the foot is performed, a position which is utilized for bringing out isolated action of the soleus. The soleus muscle, with origin below the knee joint, will perform plantar flexion equally well whether the knee is flexed or extended. In the flexed position, therefore, one relies mainly on the soleus for plantar flexion of the foot, whereas in the extended position both soleus and gastrocnemius come into action.

Maximum lengthening of the gastrocnemius is brought about by simultaneous extension of the knee and dorsal flexion of the foot. The limit is soon reached and further dorsal flexion is prevented by the tension in the gastrocnemius. For this reason, it is a good rule to maintain the knee somewhat flexed when testing and training weak dorsal flexors.

An interesting way of using the gastrocnemius for action at the knee was seen in a subject with complete quadriceps paralysis. This person walked with the knee of the affected side slightly bent and the heel off the ground, leaning forward sufficiently to keep the center of gravity slightly in front of the knee joint. The gastrocnemius then pulled backward on the condyles of the femur and became a knee extensor. The body weight was balanced so skilfully and the gastrocnemius (which was considerably hypertrophied) performed its action so efficiently that the subject did not need to put the hand on the thigh to prevent the knee from bending, as is seen in other subjects with the same defect.

PLURIARTICULAR MUSCLES OF THE HAND

A study of the muscles which control fingers and wrist brings out interesting examples of the principles of fixation, angle of pull, maximum useful shortening and maximum lengthening.

Flexor digitorum sublimis and profundus

These two muscles cross the wrist joint, the metacarpophalangeal joints and the interphalangeal joints. They will act on all joints simultaneously, if there is no fixation: on the fingers alone, if the wrist is stabilized; on the wrist alone, if the fingers are stabilized.

The most important function of the hand is to grasp objects and to hold them firmly. For this performance the finger flexors are called upon to contract, but they cannot act efficiently unless there is a stabilization at the wrist. If the hand is allowed to palmar flex while an object is grasped, the grip becomes weaker; in complete palmar flexion of the hand practically all strength is lost in the finger flexors (maximum useful shortening of these muscles has been reached). To secure a firm grip, therefore, the wrist must be held in a neutral position or in a dorsiflexed position; that is, there must be co-contraction of the extensors of the wrist. This occurs reflexively and is a pattern so well established that the average person cannot omit it.

To verify this statement, make the following test: place a small object in the hand. Palpate the tendons of the extensor carpi radialis longus and brevis at the wrist. Each time the object is squeezed they can be felt rising in strong contraction. Now support your hand in dorsal flexion by using your other hand or an object for fixation. See if you can omit the contraction of the wrist extensors. The reflex contraction of the wrist extensors, stabilizing the hand in dorsal flexion, obviously has two purposes: 1) It puts the finger flexors on a stretch, increasing their tension and thereby their strength, and (2) it prevents the finger flexors from acting on the wrist. A subject with paralysis of the wrist extensors is at great disadvantage when grasping an object. For such cases an operative fixation of the wrist in a dorsiflexed position is of much benefit.

In order to transfer the action of the long finger flexors to the wrist, there must be a fixation of the interphalangeal and the metacarpophalangeal joints by antagonistic muscles. This, in normal subjects, does not occur, since it is more economical to use the palmar flexors of the wrist for the movement. Only when maximum effort is required at the wrist will the finger flexors be seen assisting. A subject with paralysis of the wrist flexors, however, will use the long finger flexors for palmar flexion of the hand. It is done in a very typical way. The fingers are held rigid in a semiflexed position, and with considerable effort the hand is palmar flexed. Two cases recently observed by the writer could perform palmar flexion of the hand against gravity and a small amount of resistance, although no trace of contraction could be discovered in the wrist flexors. When these subjects were told to wiggle the fingers (small flexion-extension motions) while attempting to palmar flex the hand, the latter movement could not be performed. Small rapid movements of the fingers prevent stabilization at interphalangeal and metacarpophalangeal joints and thus the finger flexors cannot be used for wrist flexion.

The substitution of the long finger flexors for the wrist flexors must be guarded against when a muscle test is given. To eliminate such substitution, if not desired, the fingers should be kept moving, as described above. It always should be indicated on the muscle chart whether the grade applies to the movement of wrist flexion, regardless of which muscles perform the motion, or whether it applies to the wrist flexors proper. In the former instance (for the subject mentioned above), the grade would be "fair plus"; in the latter it would be "zero."

The action of the long finger flexors on the metacarpophalangeal joints, in brief, may be stated as follows: With stabilization at the wrist, the flexor digitorum sublimis and profundus, when flexing the interphalangeal joints, will tend also to flex the metacarpophalangeal joints. However, the interphalangeal joints always respond more readily than the metacarpophalangeal joints, because of their complete lack of fixation and because of more favorable angle of pull. If the metacarpophalangeal joints are in a hyperextended position, the angle of pull on the metacarpophalangeal joints is definitely unfavorable —a finger posture which is typical of a patient with lumbricales paralysis. Such a patient, when making a fist, will first flex the interphalangeal, and, thereafter, the metacarpophalangeal joints (Fig. 5). The motion may be described as "rolling the fingers into the palm." Some subjects acquire a considerable skill and speed in performing this motion, so that the inexperienced observer may not notice the "rolling." If the closing of the hand is performed slowly, the pattern readily can be observed.

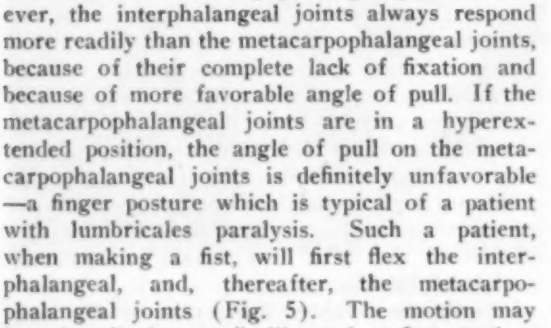


Figure 5. Paralysis of the lumbricales. Note the empty spaces in the palm. When patient is asked to make a fist he first flexes the interphalangeal joints by using flexor digitorum sublimis and profundus. Thereafter, the metacarpophalangeal joints are flexed by continued action of the same muscles. This "rolling" motion of the finger is typical for lumbricales paralysis.

Isolated flexion of the proximal interphalangeal joint is not a very difficult coordination. The movement is performed by the flexor digitorum sublimis, while the flexor digitorum profundus remains inactive. Fixation of the metacarpophalangeal joints is obtained by the action of the extensor digitorum communis and at the wrist by the extensors of the wrist.

Isolated flexion of the distal interphalangeal joint is more difficult to obtain. It is performed by the flexor digitorum profundus, but since this muscle has a very good angle of pull on the proximal joint as well, the two joints will move simultaneously. Hyperextension of the proximal interphalangeal joint, however, stabilizes it and enables the subject to move the distal phalanx separately. There are comparatively few individuals who are capable of hyperextension at this joint, hence most subjects are unable to perform isolated flexion at the distal interphalangeal joint. A great number of students were tested, but only those who were "double-jointed" could perform the motion.

Extensor digitorum communis

The relationship between the extensor digitorum communis and the flexors of the wrist is analogous to that of the finger flexors and the wrist extensors. To prevent the extensor digitorum communis from acting on the wrist there is a reflex contraction of the wrist flexors. Complete dorsal flexion of the hand hinders extension of the fingers. In order to transfer the action of the extensor digitorum communis to the wrist, there must be fixation of the metacarpophalangeal joints by antagonistic muscles (lumbricales). Subjects with paralysis of the extensors of the wrist attempt such substitution, but the movement is not very successful, and it is practically impossible if there is a paralysis of the lumbricales as well. To secure relaxation of the extensor digitorum communis during wrist extension the subject should be asked to "wiggle" the fingers.

SYNERGISM-ANTAGONISM-PSEUDANTAGONISM

When discussing the action of pluriarticular muscles one cannot avoid touching upon the question of reciprocal innervation. The law of reciprocal innervation states that "augmentation of contraction does not proceed simultaneously in antagonistic muscles" and "diminution of contraction does not proceed in protagonists and antagonists at the same time."[3] Although the re-

flex pattern of reciprocal innervation seems at times to be inhibited by other reflexes or through cortical influences, it can be observed in most coordinated motions. When the flexor carpi radialis increases its contraction to produce palmar flexion of the hand, the extensor carpi radialis decreases its contraction; when the supinators shorten to produce supination of the forearm, the pronators elongate, and vice versa. However, there are very few muscles in the body which always behave in the same way. It often happens that two muscles are antagonists in one movement and protagonists or synergists in another. The biceps brachii acting in supination is antagonistic to the pronator teres acting in pronation; in flexion of the forearm these two muscles act together. The biceps is antagonistic to the triceps in regard to flexion-extension of the forearm; when one uses a screw driver they act as synergists. In simple flexion and extension of the leg the gastrocnemius and the quadriceps are antagonists, but in simultaneous extension of the leg and plantar flexion of the foot they are synergists. The thigh flexors are antagonistic to the hamstrings in regard to the hip; yet, in simultaneous thigh and leg flexion they are synergists.

To avoid confusion in regard to reciprocal innervation, it is wise not to consider any two muscles or muscle groups as permanent antagonists, but rather to study their behavior in regard to definite movements. Creed[4] distinguishes between *antagonists* and *pseudantagonists*: "A muscle which by fixing a joint enhances the effect of another muscle crossing that joint to act on a further one is said to be the latter muscle's pseudantagonist. In simple reflex flexion of the knee, semitendinosus, a knee flexor, contracts, while vasto-crureus, the knee extensor, relaxes (reciprocal innervation). But at hip, semitendinosus is an extensor, and the reflex taxis throws it and the hip flexors into contraction together. The hip flexors by preventing hip extension antagonize semitendinosus in its action at the hip but enhance it as a flexor of the knee. . . . . Pseudantagonism is really a form of synergism and reflex coordination deals with it as with other synergism not by reciprocal innervation but by co-contraction."

SUMMARY

A study of pluriarticular muscles revealed the following points:

1. Through fixation of one joint, action on another joint may be secured.
2. Small angle of pull at one joint favors action at the others. The angle of pull of a muscle may be improved by placing the joint in a different position, thereby overcoming the "dead point." Muscle action changes accordingly.
3. A muscle is capable only of a small amount of useful shortening. When a pluriarticular muscle is allowed to act on all joints which it crosses simultaneously, it usually is unable to complete full range of motion.
4. A muscle is capable only of elongating a certain distance. If a pluriarticular muscle is put on a stretch from both ends it may prevent full action of its antagonist.
5. Some rules for muscle testing and re-education were formulated. It was suggested that the following combinations be used:

   Hip and knee

   Flexion of thigh—flexion of leg
   Extension of thigh—extension of leg

   Ankle

   Dorsal flexion of foot—knee flexed
   Plantar flexion of foot—knee extended
   Plantar flexion of foot—knee flexed for isolated action of the soleus

   Wrist

   To eliminate action of finger flexors on the wrist, subject performs small rapid finger movements while palmar flexing the hand.

   To eliminate action of finger extensors on the wrist, the same finger movements are carried out while the subject dorsiflexes the hand.

   Interphalangeal joints

   Flexion of fingers—hand in dorsal flexion
   Extension of fingers—hand in palmar flexion (or neutral position)
6. The subject of synergism, antagonism and pseudantagonism was briefly discussed. Reciprocal innervation holds for antagonists, but pseudantagonists, like synergists, are co-contractors.

BIBLIOGRAPHY

1. Krukenberg, H.: Uber die Verwendung der Bauchmuskulatur in der Orthopädischen Chirurgie, Ztsch. f. Orth. Chir., 42:193-217 (1922).
2. Gray's Anatomy, 23rd Edition, p. 365.
3. Fulton, J. F.: Muscular Contraction and Reflex Control of Movement. The Williams and Wilkins Co., Baltimore, 1926.
4. Creed, Denny-Brown, et al.: Reflex Activity of the Spinal Cord. The Clarendon Press, Oxford, 1932, p. 131.

Physical Therapy as a Vocation

Ida May Hazenhyer, M.A.

Physical therapy, as we now know it, is a new profession; as the ancients knew it, it is as old as history. Hippocrates, the famous physician of the fifth century B.C., the ancient Egyptians, the early Greeks, all knew the value of sun treatments and baths of various sorts. Through the centuries people have turned to the physical sources of nature to maintain their health and to the same sources in time of illness. Likewise, they have used the old and tried measures of massage and exercise. In the ancient days these physical forms were regarded with high respect and administered with the honest conviction of real worth. But more recently, in the years before the First World War, treatments in the class of physical therapy, though they were not known by that name, were not looked upon with favor in the United States. They were used chiefly by those who did not have a reasonable knowledge of the work and who were interested in presenting to patients an attractive, different and often spectacular form of treatment. Most of these people were classed as quacks. But with World War I the pendulum began to swing back toward the high and respectable regard of the ancients, and forward, across the disreputable period, to the present time in which physical therapy takes its place in the legitimate practice of medicine. Dr. Frank B. Granger, who was already developing this new work in Boston when the war broke out, was placed in charge of all physical therapy in the army hospitals. Through his efforts and enthusiasm and those of others interested, the profession was greatly advanced and became a part of every army hospital. When the emergency hospitals were closed and the remaining soldiers sent to regular army hospitals, the work was and still is carried on in these institutions. It was the pioneering in the army which demonstrated that there was something to this physical form of treatment.

A second great impetus was given to physical therapy when, in 1925, the Council on Physical Therapy of the American Medical Association was instituted. The purpose of this council was to lift the profession out of the still somewhat hazy atmosphere in which it struggled, place it in the realm of a recognized form of treatment and give to it the dignity of an ethical part of medicine. Among the many services the council has rendered in these years is that of investigating and approving, or disapproving, the equipment put out by manufacturers so that physicians and institutions purchasing such equipment may have some means of knowing the value of it. Through the diligence of the Council, much that was undesirable in the entire field was corrected or weeded out. There are still the quacks, as there are in other fields, and there are still those with only a slim hold on the work, but the profession is now firmly established. "Today we may say that it has assumed its correct position in ethical medical practice and has become a definite part of modern medicine."[1]

For physical therapy technicians, the group in which we are especially interested, the American Physiotherapy Association has done an important work. This association, a direct outcome of war service, was organized by a group of ex-army aides in 1921 under the name of American Women's Physical Therapeutic Association. Shortly after, the name was changed to the present one, and membership was opened to men. From that original small group of aides, the association has developed in numbers, in professional standards and in its influence among those practicing as technicians. There are now approximately fourteen hundred members in the United States, and a few are in foreign lands. From a single little group in New York, the place of the first meeting, the organization has branched out over the country into thirty-three chapters and many members-at-large. During the years since its birth, the primary endeavor of the association has been: to form a nation-wide organ which will maintain a professional and scientific standard for those engaged in physical therapy; to promote

Physical Therapist, Jahn School for Crippled Children, Chicago, Illinois.

the art of physical therapy; to aid in the establishment of educational standards and scientific research in physical therapy; and to cooperate with and to work only under the prescription of members of the medical profession.[2]

One of the chief means of disseminating knowledge and advancing standards is through the official publication, THE PHYSIOTHERAPY REVIEW. The journal not only reaches every member, but it also enjoys an extensive subscription circulation. Upon its mailing list are found many institutions in this country, and a goodly number in Europe, South America, Australia and other countries. Likewise, many individuals who are not members of the association find the journal profitable reading, for the articles, dealing with all phases of physical therapy, are written by members of the medical profession and of the association, and by specialists in physical therapy and allied fields.

The National Foundation for Infantile Paralysis, realizing the importance of physical therapy in the care of poliomyelitis patients, has made a grant to the association for the purpose of making a survey in this field. The association has sent questionnaires to hospitals, crippled children's schools, physical therapy schools, private and governmental agencies, and individuals working with poliomyelitis patients. The purpose of the survey is to gather information concerning treatment in the various institutions, and to compare and evaluate this material. The results of the survey will be of benefit to all who are interested in the work.

Yet another indication of the growth of physical therapy is the establishment, a few years ago, of the American Registry of Physical Therapy Technicians. The purpose of this registry is to cooperate with the Council on Medical Education and Hospitals of the American Medical Association in the attempt to maintain high standards for technicians, and to make available to the technicians a registry which will help protect the ethical members of the profession and provide adequately trained technicians for institutions with physical therapy departments. Only graduates of schools approved by the Council on Medical Education and Hospitals of the American Medical Association are eligible for the registry examination. The registry also maintains a placement bureau. The registry is governed by the American Congress of Physical Therapy, and the advisory council consists of seven members representing the following organizations: American Congress of Physical Therapy, American Physiotherapy Association, American Hospital Association, American Orthopedic Association and the American Neurological Association.

To realize how much physical therapy has advanced since the war, one need only to glance through the medical literature and note the references made to this treatment. As late as 1925 little was said about physical therapy, and those who wished to "read up" on the subject had difficulty in finding anything to read. Now there are many books dealing exclusively with the subject: books on electrotherapy, on massage and exercise, and books covering other phases. One of the notable publications is the *Principles and Practice of Physical Therapy*, edited by Mock, Pemberton and Coulter, 1937. This original work is revised and additions are made from time to time as new findings are made in the field. *The Year Book of Physical Therapy* by Richard Kovacs, M. D., published annually, and *Physical Medicine* by Frank Krusen, M. D., are entirely devoted to the subject. *Archives of Physical Therapy* is the publication of The American Congress of Physical Therapy. The *Journal of the American Medical Association* devotes a column to physical therapy and carries many articles on the subject. Articles are to be found in other medical journals as well. "The fact that physical therapy is receiving more attention in the medical literature is obvious to any one who glances through current journals or the Cumulative Index Medicus and compares these with a journal or a volume of the Index published five years ago."[1]

Attention may be called to a few of the books published recently which recommend physical therapy treatment for various diseases: *The Cyclopedia of Medicine*, 1941; *Treatment in General Medicine*, edited by Hobart A. Reimann, M. D., 1941; *Modern Medical Therapy in General Practice*, by D. P. Barr, M. D., 1940; *The Foot and Ankle*, and *Infantile Paralysis*, by Philip Lewin, M. D., 1941; *Diseases of the Foot*, by Emil D. W. Hauser, M. D., 1939; *Arthritis and Allied Conditions*, by Bernard Comroe, M. D., 1940; *Diagnosis and Treatment of Arthritis and Allied Disorders*, by H. M. Margolis, M. D., 1941; *Body Mechanics*, by J. E. Goldthwait, M. D., 1941; and *Care of Poliomyelitis*, by Jessie L. Stevenson, R. N., 1940.

Many medical publications on subjects other than orthopedics now recommend physical therapy, such as: *The Treatment of Diabetes Mellitus*, by Elliot P. Joslin, M. D., 1940, recommending exercise; *Manual of Peripheral Vascular Disorders*, by David W. Kramer, M. D.,

recommending physical therapy; *Management of the Cardiac Patient*, by Williams G. Leaman, M. D., 1940, having a section on physical therapy and exercise; *Diseases of the Skin*, by George C. Andrews, M. D.; and *Neurological Surgery*, by Loyal Davis, M. D.

EXTENT OF USAGE

Briefly, physical therapy as it applies to technicians is defined as: the treatment of disease by nonmedical means, comprising the use of massage, exercise, and physical, chemical, and other properties of heat, light, water, electricity (except roentgen rays, radium and electrosurgery).[3] Hospitals and clinics usually make use of all forms of physical therapy while schools for crippled children and welfare institutions confine themselves to massage, exercise, hydrotherapy and sometimes ultraviolet. This difference is due to the fact that the patients differ in the two groups. In hospitals where all types of conditions, both acute and chronic, are encountered, all physical therapy procedures are indicated. In the other institutions the individuals are patients with physical handicaps which, to a certain extent, are chronic. In these latter places are found the cases of post-poliomyelitis, cerebral injuries, congenital conditions, chronic arthritis, old traumatic injuries and various conditions which profit by long term physical therapy procedures indicated primarily for reeducation and rehabilitation.

Adequate figures showing how many technicians are in the different institutions are not available, but we do know that countless hospitals throughout the country maintain physical therapy departments: orthopedic, general, children's, industrial hospitals, institutions for mental patients, army and veterans' bureau hospitals, clinics. The *Manual of Hospital Standardization* prepared by the American College of Surgeons, in discussing the minimum standards for hospitals, urges the establishment of physical therapy departments: "Physical therapy has proved so advantageous in cases such as fractures, diseases of metabolism, and nervous disorders that almost every general hospital would find considerable use for such a department. This specialty frequently hastens convalescence, shortens the patient's average stay in the hospital, and improves end results. . . . It is important that well trained technicians be available to assist the director in the treatment of these cases. . . . The educational standards for technicians or aides should be those established by the American Physiotherapy Association."

Almost all schools for crippled children offer physical therapy treatments. In some small schools and in special classes held in regular schools, there may be a part-time technician who divides her time between two schools, or between school and another position; but in the larger schools many technicians are employed. The states of Ohio and Wisconsin have a commendable set-up for work with crippled children—Ohio under the Department of Education, Wisconsin under the Department of Public Instruction. Under these state organizations physical therapy technicians are sent out to serve in orthopedic schools.

Besides hospitals and crippled children's schools, many other institutions make use of physical therapy: public welfare organizations, national, state, and city; private organizations, such as visiting nurse associations, the Curative Workshop in Minneapolis, the Junior League Workshop in Milwaukee, the Foundation at Warm Springs. Some camps for crippled children likewise offer treatments during the time the children are in camp; for instance, Robin Hood's Barn in Vermont and the Outing Association for Crippled Children in Wisconsin.

The U. S. Department of Labor, Children's Bureau, reports December 1941, that thirty-seven states employ a hundred and one physical therapy technicians. "The program of every state aims to provide through the crippled children's agency established under state law . . . skilled medical, surgical, nursing, physical therapy, and social services for children in hospitals, convalescent homes and foster homes."[4] The aim is also to provide physical therapy services for crippled children at home following hospital care, or for those who do not need hospitalization.

At the present time perhaps no field in physical therapy is more interesting and timely than that of government service. As was stated earlier in this article, physical therapy received its initial impetus during the last war; in this war it is expected that the work will play a far more important part because now physical therapy is considered an integral part of medicine. Quite some time before December 7, 1941, our government was already investigating the matter, and the American Red Cross was receiving applications from those who were willing to place their names upon a list which would make available to the government qualified technicians, or aides, as they are called in the army. How many technicians will be needed during this war we do not know, but an estimate has been made in an article about to be published, entitled "*The Need*

for Physical Therapy Technicians, by John S. Coulter, M. D. and Howard A. Carter. We add here three other items from the same source:

U. S. Army Hospitals	2100
Civilian Hospitals	1478
Crippled Children's Schools	1682
Children's Bureau, U. S. Dept. of Labor	710

The above estimate would indicate that the demand is greater than the supply, and for this shortage we offer three possible explanations. First: the field is comparatively new. Second: the requirements are exacting. Nurses and teachers of physical education may argue that they can do as well in the fields for which they are already prepared without the added time and expense of taking physical therapy courses. Third: until war was declared, few people were ready to prepare themselves and offer services. However, now that war is here, it is believed that many who are eligible will enter the six month courses prepared in several institutions for the purpose of training army aides. As for the second above explanation, it is likewise believed that as physical therapy continues to grow in importance, many more teachers of physical education and nurses and students with science majors will avail themselves of the privilege of joining the ranks of a highly specialized profession.

The American Physiotherapy Association maintains a vocational service without charge through which the members may apply for positions, and institutions and physicians may obtain qualified technicians. This service is conducted through the permanent office of the American Physiotherapy Association, 737 North Michigan Avenue, Chicago, Illinois.

BASIC QUALIFICATIONS

In any professional field, education and training are very important, and these qualifications in relation to physical therapy will be taken up a little later. But before these there should come a consideration of the character and aspirations of the individuals who are in the work and those who seek to find a place in it; for even education and training are not sufficient to make a desirable and successful technician who can do the work and carry on the standards set by the American Physiotherapy Association for its members, and by the American Medical Association for all those in the work.

In any profession, the—shall we call it "temperamental"— qualification is all-important, but in the two fields dealing with the minds and bodies of individuals it is especially so; for within the realms of these two fields falls the molding of the physical and moral make-up of the race. The best teachers' college in the country cannot turn out a first-class teacher unless that teacher has an inherent capacity and love for teaching. Knowledge of the subject and methods of presenting it are necessary, to be sure, but expounding knowledge without spirit is a mechanical procedure. The same is true of a profession which has to do with the body. A physical therapy technician may know anatomy and the allied subjects, may know how to perform the movements of massage and what exercises are best for given afflictions and may know the technic of administering diathermy, but unless the technician has that other qualification which makes a perfect teacher, he or she will not make a first-class worker in physical therapy.

A patient is not a mechanical machine, wonderful as is his mechanism; he has a mind and a temperament. The medical profession recognizes this. A conscientious physician looks upon his patient as a being with two parts, body and mind, and while he deals with the body he does not forget that the body is a human one governed by that patient's individuality.

What then are the basic qualifications necessary in the making of a good technician? There must, of course, be an interest in the work beyond that of a means of making a living. It must be the interest of a professional worker rather than that of a piece worker in a factory or a salesman in a store or a stenographer in an office. Scientific research is constantly offering new ideas in physical therapy. The field is still young, and no one can afford to lean complaisantly back upon the certificate or diploma received from a course in physical therapy and feel that that course is the end of education. A profession calls for more than mechanical efficiency.

Not only is an interest in the profession necessary; there is the equally important question of an interest in the type of individuals with whom the technician works, whether these people are crippled children or adults with their various difficulties, civilians or ex-soldiers, patients with physical handicaps or those with neurasthenic tendencies. All of these appear before the technicians in the various departments of physical therapy. The people working with these patients

need an understanding of and a healthy sympathy for them. It is a human laboratory in which the technicians work. If a patient can feel no bond between himself and his operator, the good results of the treatment will be decreased by the patient's state of mind. Especially true is this in the field of massage where there is a direct contact between patient and operator.

But there is yet another point in this somewhat intangible realm of basic qualifications—the ethical standards adhered to by the American Physiotherapy Association, set forth in its by-laws: (1) The members of the American Physiotherapy Association shall work only under medical supervision or direction; (2) the members of the American Physiotherapy Association shall not advertise. Technicians do not have either the education or the legal right to diagnose and prescribe; their training and knowledge are limited to treating only under the supervision of physicians. This is an important point, and one which when violated places the workers in the realm of cults and quacks. There are the so-called physical therapists who do take upon themselves the privilege of working independently, but these are the people who are not only a hindrance to the art of physical therapy but are a danger to the patients who unwittingly submit themselves into incapable hands. There are uses and abuses of physical therapy, and only an ethical cooperation with physicians will make the profession useful in the fields of its legitimate indications.

If the prospective worker in physical therapy is not ready and temperamentally fitted to meet the prerequisites of a good technician, it were better to side-step this profession and turn to a job in which character and personality are of less importance and one in which less damage can be done. For, let it be repeated, the physical therapy technician works with human bodies and personalities.

EDUCATION AND TRAINING

Before the World War I, there was no such thing as a school of physical therapy, or even a short course. It was during the emergency of the war that a few short courses were started to train "aides" who were to serve in reconstruction hospitals, and for a few more years these courses were all we had. Later, several other courses were offered in different places, but there was no standard by which they might be evaluated and no standard toward which they might aspire. Neither did those wishing to take courses have any definite means of knowing which courses were the best. The American Physiotherapy Association attempted to evaluate schools but its facilities for thorough investigation were necessarily limited. The American Medical Association was persuaded of the necessity of standardization and undertook, through the Council on Medical Education and Hospitals, to make a survey of the existing schools offering physical therapy and to draw up the "Essentials of an Acceptable School for Physical Therapy Technicians." Among other stipulations in these essentials are statements of requirements for admission, and a minimum curriculum:

REQUIREMENTS FOR ADMISSION

Candidates for admission should be able to satisfy one of the following requirements:

a. Two years or sixty semester hours of college, including courses in physics and biology.
b. Graduation from an accredited school of nursing.
c. Graduation from an accredited school of physical education.

Courses in general physics, chemistry and biology are highly recommended for all who seek to enter training in physical therapy.

MINIMUM CURRICULUM

Subjects	Hours	
	Theory	Laboratory and Practice
Anatomy (including applied anatomy, demonstration on cadaver and lecture)	210	
Clinical practice		400
Electrotherapy	30	45
Ethics and administration	5	
Hydrotherapy	5	15
Massage	15	45
Pathology	30	
Physiology	30	45
Principles of physical therapy as applied to:		
Medicine	15	30
Neurology	10	15
Orthopedics	15	30
Surgery (including surgical observation)	15	30
Psychology	15	
Therapeutic exercise	30	75
Electives	45	
	470	730
Total	1,200 hours	

Suggested electives: asepsis, bandaging, first aid, history of physical therapy, hygiene, joint measurements, office routine, occupational therapy, records, social service.

All subjects should be taught by qualified teachers. Length of course: Not less than nine months.

Following the survey of the schools offering physical therapy, fourteen schools were ap-

proved and placed upon the accredited list. Since then, two more have been added. The latest list appears annually in the "Education" issue of the *Journal of the American Medical Association*, in March, and is reprinted annually in the May-June issue of *The Physiotherapy Review*.

Due to the present war emergency and the anticipated need for army aides, there are approved schools offering six months theory followed by six months as Apprentice Physical Therapy aides in an army hospital to facilitate the training of technicians for government service. When their practical work has been completed satisfactorily they will be issued the certificates or diplomas of the school from which they received their initial training.

*The student desiring to enter an emergency course should check carefully that the course selected has the approval of the Council on Medical Education of the American Medical Association.**

The requirements for membership in the American Physiotherapy Association have been developed through the years. As stated above, the charter members and those joining in the first months were ex-army aides with such training as was offered at that time and with valuable experience acquired in the army. During the first years of the association's existence, applications for membership had to be considered by the executive committee on the basis of then-existing conditions. Experience was an important item, for chiefly by that could fitness for membership be judged. However, after a number of accredited courses in physical therapy were offered, the association was able to place its requirements for membership on definite educational standards. Because there were still some technicians whose experience and general qualifications made them desirable for membership but who had not received a diploma from an approved school, examinations were offered in lieu of the credits. However, these examinations are no longer offered. Now, all applicants for membership must meet the requirements as set forth in the by-laws of the association:

1. Active members shall be admitted as follows: Active members shall have at least one year's practice in physical therapy within two years of graduation from:

a. A school of physical therapy acceptable to the American Physiotherapy Association, by which is meant a school which gives not less than three years' training in physical therapy.

b. A course in physical therapy acceptable to the American Physiotherapy Association, by which is meant a course in physical therapy of not less than nine months following graduation from a school of physical education, or a school of nursing which meets the requirements set by law in the individual states, or sixty college semester hours, twenty-six of which shall include physics, chemistry and biological sciences.

Because of the elimination of examinations, foreign trained technicians may submit their credits to the approved schools of this country which have expressed willingness to evaluate such credits, and if the credits meet the requirements of the American Medical Association, the school will give such persons credit toward graduation. When the foreign trained technician has graduated from such a school, he or she may apply for membership in the American Physiotherapy Association.

SALARY

We leave to the last that which, idealistically, should be left to the last in considering a professional vocation—monetary remuneration. The results of a survey made by the American Physiotherapy Association among its members show a varying scale. From scarcely a living wage, the salaries ranged upward to $4,000. The association, after studying the responses of its members, formulated a scale which will be available to the members and to interested organizations. The majority of opinion was that $1500 without maintenance is a reasonable salary for a minimum beginning salary of graduates of approved schools. Likewise, a yearly raise of $100 is reasonable, depending, of course, upon the amount of responsibility demanded, and these increases should continue until a maximum commensurate with the demands of the position is reached. It is the opinion of the association that salary increases should be based not only upon experience but also upon continued study and improvement in the professional field. Since a physical therapy technician has at least one year of professional study beyond that of a nurse or teacher of physical education, the physical therapy salary should be higher than in these other fields.

To those who are keenly interested in salaries, the "scarcely a living wage" may seem discouraging considering the extent of training demanded. But the prospective technician need not be discomfited since the same is true in any profession. And in physical therapy as in others, there is the opportunity to climb the

*See list on page 101.

monetary ladder until the feet stand on the topmost rung. This materialistic ambition need not be discouraged, but a warning must be sounded. Physical therapy is not a money-making business; it is a profession which calls for more than a mere means of "doing something for a living," a profession which demands an honest interest in the work and in the patients. And when that prospective technician has reached the top of the salary ladder and no higher salaries appear on the horizon, there still remain the never-ending horizons of interest and professional achievement.

REFERENCES

1. Report of the Committee on the Present Status of Physical Therapy. Report of Council on Physical Therapy, The Physiotherapy Review, Nov.-Dec, 1936, reprinted from the Journal of the American Medical Association, Aug. 22, 1936.
2. Constitution of the American Physiotherapy Association.
3. Ibid.
4. Facts About Crippled Children, published by the U. S. Dept. of Labor, Children's Bureau, March 1941.
5. Journal of the American Medical Association, Mar. 22, 1941.

How to Relax

"If we could learn how to balance rest against effort, calmness against strain, quiet against turmoil," says Dr. Josephine Rathbone, "we would assure ourselves of joy in living and pyschophysical health for life." The psychologists believe that people who live dynamically without being too tense have four main attributes: first, rhythm in their activities with great swings in output and accomplishment, alternating with periods of repose; second, a sense of values which makes it possible to minimize effort and minimize strain; third, ability to reduce muscular tension in any part of the body consciously whenever desired, and, fourth, a readiness to fall asleep at will.

While these attributes may develop spontaneously to some extent in some persons, it is also possible to cultivate them in a measure. In order to aid such cultivation, ten tricks are presented which are believed to be useful in realizing relaxation. They are:

1. Cut down on the intensity of your thinking half an hour before retiring. (Play Chinese checkers, plan an excursion for the week end, write a letter to a friend, fill with pleasant things you have been doing.)

2. Take plenty of time to get ready for bed (next morning's clothes, leisurely bath, and so on).

3. If you like to read in bed choose nonfiction or a "hard" book. Force your mind to grapple with cumbersome facts, bore it into unconditional surrender to sleep.

4. Transplant your mind from fears or hates to a field which has interest without excitement (a new wardrobe, possibly).

5. Make your mind hop from one idea to another. Just as the mind loses consciousness and sleep comes, thoughts become disjointed and scattered. (Start with some happy episode in childhood, for example).

6. To quiet the body, get rid of any pressure or pain. (Lighten weight of covers, clothes).

7. Tepid bath without a rubdown. (Get into bed a little damp and chilly. As the body becomes warmed it becomes more and more comfortable. If during the night one becomes sleepless, throw back covers until body becomes uncomfortably chilly. Then when the covers are pulled up again, the body once more sinks into coziness.)

8. Imitate the slow, deep rhythmical breathing of sleep. (Helps regulate the circulation and may ease the mind and emotions; also tensions in the abdomen.)

9. Relax the muscles completely.

10. Get rested before trying to sleep. (Get into bed an hour or more before your regular time for retiring. Do so night after night to build up a reserve of rest and fall asleep without the old struggle.)

The balance between what can be accomplished by education and practice and what is innate in producing relaxation and longevity is a delicate one. Physicians have long known that people with a low blood pressure, a low basal metabolic rate, a low pulse rate and a low intake of food—if all of these are not too low—tend to live longer than those in whom these physical factors are at extremely high levels. Perhaps equally important is a low threshold for the sense of humor—a mental attitude which does not take life too seriously.

Reprinted from the J.A.M.A., 118:7:537, Feb. 14, 1942.

Synchronizing Biplane Stance Photography with Center of Gravity Observations

F. A. Hellebrandt and L. E. A. Kelso

The most commonly used objective methods of studying posture are photographic. It has been abundantly recognized that gravitational stresses play an important part in the frequent attitudinal adjustments which characterize the bipedal stance of man.[1] The clinical literature on posture contains many references to the importance of the center of gravity to the study of body mechanics.[2] Although the method of doing this is simple in principle, comparatively few efforts have been made to introduce an experimentally determined weight line into posture pictures. The dropping of a plumb line from the ear has long served as an empirical substitute. The purpose of this paper is to describe the devices developed in this laboratory for the synchronization of biplane stance photography with center of gravity determinations.

To study the disposition of the segmented skeletal parts about the gravity line, photographs were taken from two positions at right angles to each other. The cameras were mounted in light-tight, ventilated cubicles equipped with a suitable safelight and a shelf for developing. Specially built camera boxes were supplied by the late Dr. Eugene Howe of Wellesley College. The lower compartment holds a 100 ft. roll of 2-¼ in. bromide paper. If single pictures are taken they may be pulled out and torn off. The top of the box is provided with a metal edge for this purpose. As used under our routine experimental conditions, the paper was drawn past the exposure compartment, through a slit, and then attached to a drum mounted in an auxiliary light-proof container resting on top of the camera box. Following the taking of a picture, the drum automatically rotates one-half revolution by a worm gear. The paper moves ahead approximately 7 in. This carries a fresh piece into the exposure compartment. The full 100 ft. thus may be automatically wound onto the drum. To remove the exposed paper in preparation for development, it is transferred to a reel suspended from the back of the drum case. The reel may be conveniently stored in a light-tight can. When ready for development, the reel is placed in a holder. The paper is unwound, sensitive face up, and passed from developer through a water bath to a reservoir of fixing solution. In actual practice, the 100 ft. strip is cut into sections of 12 or 13 pictures as the developing proceeds. After thorough washing in running water, the strips are suspended from ceiling supports with light weights attacked to the free ends. When dry the pictures are cut and stored between fiber boards held together with heavy elastic bands. This effectively prevents curling.

The cameras were placed to give an image of a size specified by the MacEwan-Howe technic of posture photography.[3] A stick of known length was photographed and matched to a standard size supplied by the Wellesley laboratory. By placing the stick at the approximate spot where the mean center of gravity projects to the base of support of the average subject, we obtained the reduction factor subsequently applied to the data to make the observations amenable to transfer to the photographs. The pictures were taken against Turkey red flannel back and side drops edged with white sheeting to reflect more light onto the subject. Satisfactory photographs were obtained at 0.1 sec. exposure using the largest stop.

Illumination was supplied by 6 photofloods in aluminum reflectors. To standardize the placing of the lamps, an area was ruled onto the floor in 1 ft. squares. These were numbered along the x and y axes of the coordinates. The lamps could thus be exactly replaced, two at head level, two at foot level, and two in intermediate

From the Department of Physiology and the Electrical Engineering Laboratory, University of Wisconsin, Madison, Wisconsin.
Supported in part by funds from the Wisconsin Alumni Research Foundation.

Fig. 1 — Normal subject standing in a relaxed and comfortable posture. Observations are made at 5 sec. intervals. Duplicate pictures are taken by voluntary control of the drum which automatically moves the paper. Deliberate time exposures sometimes show marked fanning of the Wellesley pointers in the region of the dorsolumbar spine, indicative of compensatory equilibratory adjustments localized in regions other than the ankle joint.

positions. The lights were controlled from the master cubicle through a 30 ampere Square-D switch. A special power line was run into the laboratory. Since this at times draws approximately 65 amps., the hot wire was connected to two fuses in parallel on the switch board. Two 30 amp. polarized outlets in parallel furnish power to all the devices.

The actual taking of pictures is controlled from the master cubicle. A pendant switch energizes the timing device which consists of a motor driven contactor carrying a variable number of contacting pins. These sweep across three wipers. The first energizes electromagnets which trip the camera shutters. The second simultaneously closes the d-c circuit which causes the printometer striker to move and allows the spark coils to fire. As described in the first paper of this series, the printometer records the data from which the postural sway in the two vertical orientation planes may be integrated.[4] This gives the average-time location of the center of gravity. Instantaneous observations are recorded on the kymograph as minute holes burnt into the paper each time the pin makes contact and the camera shutter opens. The third wiper on the timing device makes contact only after the first circuit is completely opened. It trips the auxiliary drum mounted on the camera, moving the paper forward in readiness for the next picture. At the same time it moves one digit on a numbering machine visible in both profile and back photographs. The circuit controlled by the last wiper may be opened by a pendant switch hanging outside the master cubicle. Under these conditions the drum does not move and composite pictures may be taken, as illustrated in Figure 1.

The experiment requires two groups of operators, those controlling the center of gravity devices and those inside the photographic enclosure. To facilitate contact between the groups, a signal system was installed. This consists of two automobile tail-lights connected in series across a 12 volt battery, and controlled by 3-way switches. For calibration purposes and other instances it may be desired to eliminate the opening of the camera shutters. This is accomplished by the introduction of an additional switch in the circuit of the first wiper, placed within easy reach outside the master cubicle.

To visualize the running of the experiment as a whole, an illustrative protocol is given. The subject comes to the laboratory and is prepared for photography by dressing in tightly fitting knit trunks. The subject puts on dark glasses to protect the eyes against the glare of the flood lights, wears a coarse white net to give the head-line a smooth light contour and a surgical face mask to disguise the features. The subject is weighed in pounds. Two operators outside the photographic enclosure then set the scale clamps of the center of gravity unit to the approximate partial weight of the subject. The scale levers are levelled and arranged to make firm contact against the drum of a large kymograph carrying a strip of paper approximately 9 ft. long and 10 in. high. Time is recorded with an electromagnetic signal. The oscillograph fields are set for the subject's weight and the oscillograph needle is centered over the zero point. When the levers of the center of gravity unit and the oscillograph needle have been adjusted, the drum is started and a 2 minute calibration run is made. This gives the needed kymographic base line of known scale load, and a basal printometer reading. For calibration purposes the printometer strikers hit at quarter minute intervals, instead of every five seconds as during the routine run. If everything has been properly adjusted the printometer readings for each 15 sec. interval check and the

oscillograph needle maintains its central position over the zero point. The oscillograph needle is then immobilized and the writing point is dropped into place. The operators throw the signal light, indicating that the subject may be placed on the platform which is out of sight in the photographic enclosure. Figure 2 illustrates the general arrangement of the photographic and center of gravity units.

While the calibrations are being made, the subject's horizontal stature is recorded and the height of the center of gravity from the soles of the feet is measured. The weight bearing foot length is determined and the foot guide adjusted to equalize the transverse and anteroposterior support diameters. A piece of absorbent paper is placed on the center of gravity platform a known distance from the supporting knife edges. The subject moistens the soles of the feet by standing in a shallow dish of potassium permanganate, and then mounts the platform. When in position, a light signal is given. This indicates that the scale clamps may be released. The subject is given ample time to relax and get into an easy natural posture. The kymograph and printometer are started. The experiment is now ready to commence. The flood lights are turned on and time is allowed for the voltage drop to be corrected by the oscillograph operator. The technician in the master cubicle throws the switch of the timing device. This opens the camera shutters, causes the spark coils to discharge into the drum and the printometer hammers to strike, marking zero time. The oscillograph operator releases the needle as the first photograph is taken. After the 13th picture, which marks the elapse of 60 seconds of time, the needle is caught and again immobilized. The operator in the master cubicle terminates the experiment by opening the switch of the timing

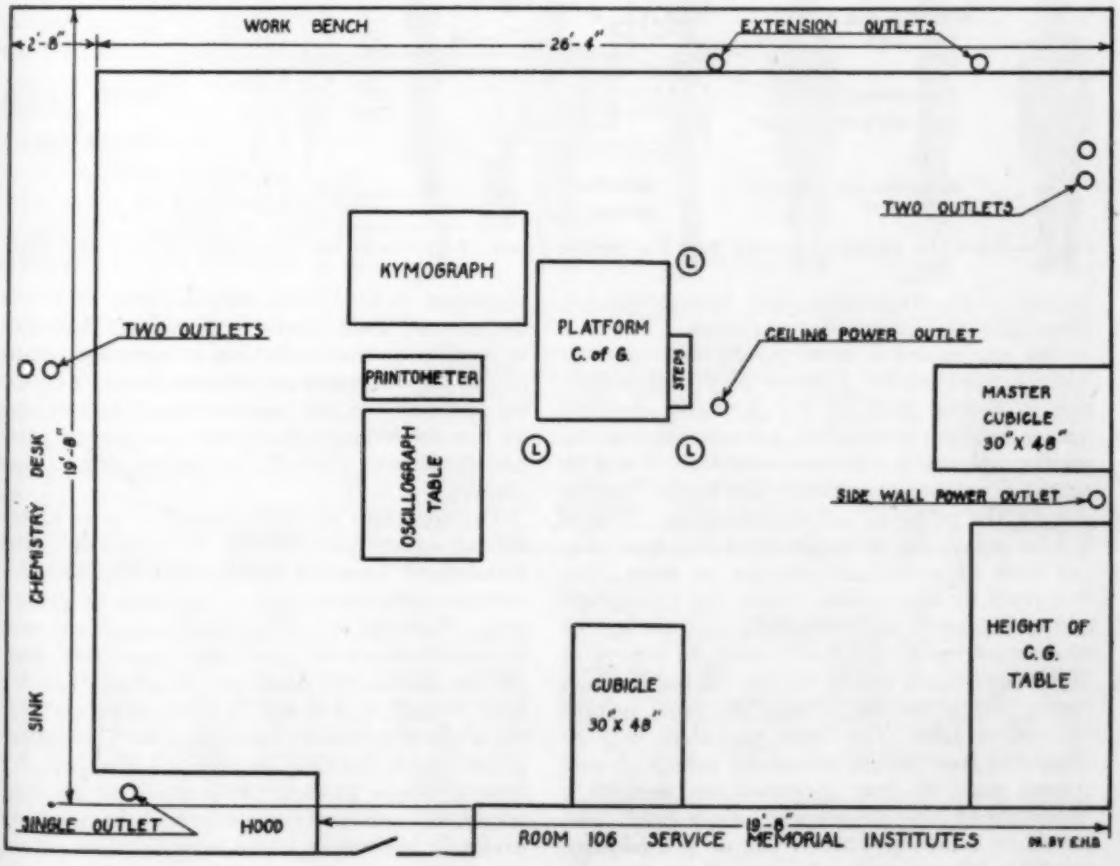


Fig. 2—Sketch showing the general arrangement of the equipment. A curtain separates the kymograph, printometer and oscillograph from the center of gravity platform and the photographic cubicles.

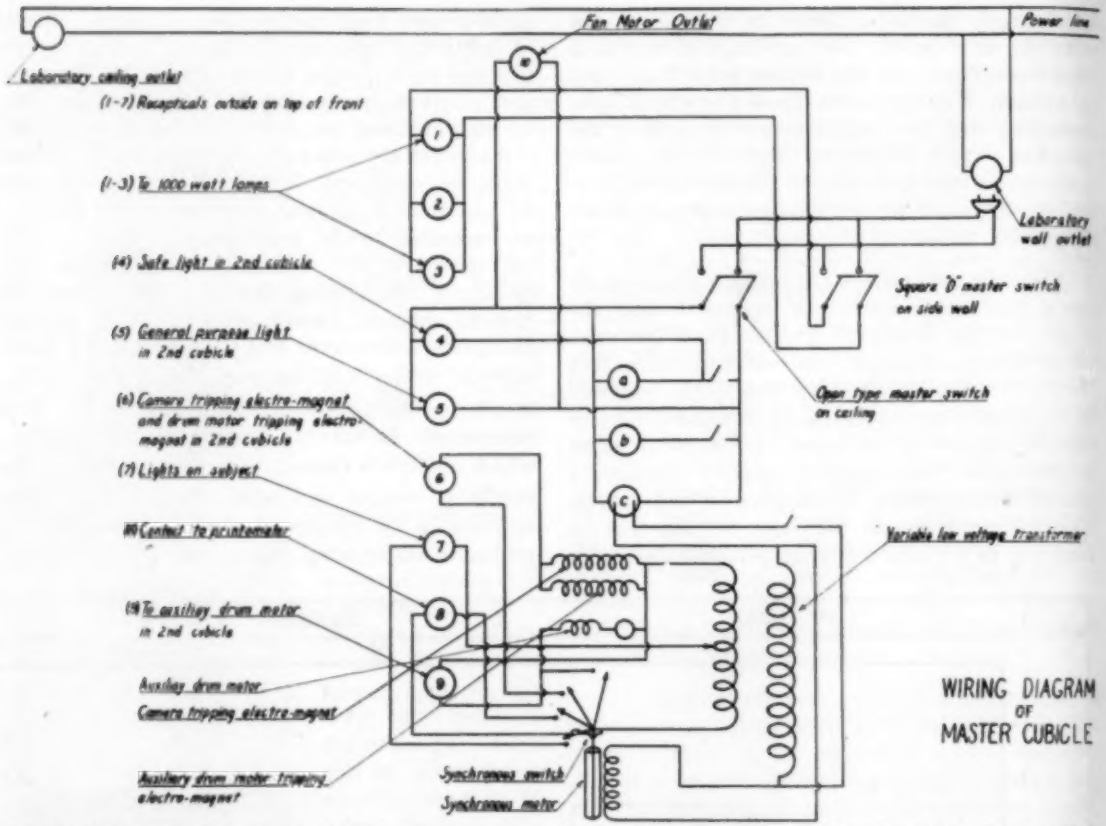

Fan Motor Outlet
Power line
Laboratory ceiling outlet
(1-7) Receptacles outside on top of front
(1-3) To 1000 watt lamps
(4) Safe light in 2nd cubicle
(5) General purpose light in 2nd cubicle
(6) Camera tripping electro-magnet and drum motor tripping electro-magnet in 2nd cubicle
(7) Lights on subject
(8) Contact to printometer
(9) To auxiliary drum motor in 2nd cubicle
Auxiliary drum motor
Camera tripping electro-magnet
Auxiliary drum motor tripping electro-magnet
Synchronous switch
Synchronous motor
Laboratory wall outlet
Spare 3 master switch on side wall
Open type master switch on ceiling
Variable low voltage transformer
WIRING DIAGRAM OF MASTER CUBICLE

Fig. 3—Schematic diagram showing how the various pieces of apparatus are interconnected and controlled.

device. The printometer and kymograph are stopped by their respective operators.

The experiment is most rapidly and economically carried out by a group of five observers, one to control each of the following devices: master cubicle, printometer, kymograph, and the oscillograph and transformer combined. The fifth operator watches the subject and assists him on and off the center of gravity platform. This is a wise precaution although there has been only one case of orthostatic syncope in more than five years of observation. Since the kymograph and printometer are essentially automatic, the whole experiment can, if necessary, be controlled by two operators, one to release the oscillograph needle and adjust the voltage, the other to take the photographs. The latter procedure may be controlled from outside the master cubicle. A well trained team of four operators can perform a maximum of four experiments in one hour. The period of standing, whether one or five minutes, has little influence upon the rate of which observations can be made in so far as most time is consumed in the preliminary adjustment of the devices and their baseline calibration. Although it requires considerable time to train the operators in the integrated performance of their duties, the technics are not inaccessible. The majority of our experiments have been performed with undergraduate physical education student assistants.

The apparatus has been devised so as to enable the use of any part without the inclusion of the remainder. Thus the photographs may be taken without operation of any of the center of gravity units. Although it is theoretically possible to take the oscillograms in a manner permitting their projection into the footprint, our experience has been limited to the use of this instrument for the illustrative value of the records. The oscillograph yields striking pictures of the subject's general stance pattern. In a study of the constancy of such patterns, this may be the only device in operation. If the mean location of the center of gravity is to be determined by averaging instantaneous kymographic points, the printo-

meter and integrating watt meters may be conveniently excluded. The apparatus lends itself to several combinations of use, depending upon the particular problem under study and the skill of the operating team. Figure 3 is a circuit diagram of the master cubicle. It shows how the various devices may be controlled by a single person. Figure 4 is an illustrative sample of the data obtained by the combined use of several of the devices.

Thus far the equipment has given service only in the study of theoretical problems in stance biodynamics and the physiology of posture. The center of gravity unit was used as the indicating device for the recording of postural sway in our studies of gravity shock, intramuscular pressure, postural reflexes and the energy cost of standing. We have observed the stance characteristics of a few cases of pseudohypertrophic muscular dystrophy and weakness secondary to adrenal insufficiency. The methods might be applicable to the study of many clinical problems such as the effectiveness of gymnastic therapeutics in the treatment of postural defects, equilibratory disturbances in labyrinthine disease and various neurological lesions, muscle reeducation, center of gravity changes in pregnancy, or the most economical manner in which to carry an army pack.

Fig. 4—Synchronous posture photography and center of gravity observations. The hollow circles locate the vertical projection of the center of gravity at 5 sec. intervals during one minute of natural comfortable standing. The small solid circle is the mean location of the center of weight arrived at by averaging the 13 instantaneous observations. It falls slightly in front and to the left of the geometric center of the total base which is indicated by a solid circle and coordinates. The biplane photographs below are those taken synchronously with the center of gravity observation most eccentric anteriorly, closest to the geometric center of the base and most eccentric posteriorly. The vertical projection of the center of gravity is introduced into each posture picture as an experimentally determined "weight line."

BIBLIOGRAPHY

1. Amar, Jules: The Human Motor. George Routledge & Sons, Ltd., London, 1920; Basler, Adolf: Der Schwerpunkt des Lebenden Menschen, Sun Yatsen University, Canton, 1931; Cureton, Thomas Kirk and J. Stuart Wickens: The Center of Gravity of the Human Body in the Antero-Posterior Plane and its Relation to Posture, Physical Fitness, and Athletic Ability. Springfield College Studies in Physical Education, Supp. Research Quarterly 6:93-105, 1935; Reynolds, Edward and E. A. Hooton: Relation of the Pelvis to Erect Posture. Am. J. Physical Anthrop. 21:253-278, April-June 1936.

2. Morton, D. J.: The Human Foot. Columbia University Press, N. Y., 1935; Myers, Ernest E.: The Management of Postural Deformities of the Lower Extremities. Am. J. Surg. 44:232-241, April 1939; Keller, Henry: The Muscular System as a Causative and a Contributing Factor in Deformities of the Human Skeleton. Med. J. & Record 130:620-624, Dec. 4, 1929; Steindler, A.: Mechanics of Normal and Pathological Locomotion in Man. Charles C. Thomas, Springfield, Ill., 1935.

3. MacEwan, Charlotte G. and Eugene C. Howe: An Objective Method of Grading Posture. Research Quart. 3:144-157, October 1932.

4. Hellebrandt, F. A., L. E. A. Kelso, and E. Corinne Fries: Devices Useful to the Physiological Study of Posture.

The Influence of Postural Sway on Stance Photography

F. A. Hellebrandt, Kathryn S. Riddle and E. Corinne Fries

We have shown previously that the center of gravity of the body as a whole shifts incessantly during so-called normal quiet standing.[1] As far as we have been able to determine this phenomenon is invariable, and under our experimental conditions, relatively little affected by sex or age.[2] Standing is associated with fluctuating changes in the intramuscular pressure of the antigravity groups of the weight-bearing limbs, suggesting that constantly varying gravitational stresses call forth different degrees of equilibrating postural contraction.[3] However, these antagonistic forces are never sufficiently balanced to make of the upright human body an immobile mass.

Standing is a more dynamic mechanism than is assumed frequently, if one can judge from the criteria of posture in common use. The most objective of these are based upon instantaneous photography, one or two records usually being considered sufficiently representative of the average stance to attach to them a considerable degree of diagnostic significance. Since most of the methods are painstakingly precise, the question which naturally arises is whether involuntary shifts in the center of gravity of the body as a whole are commonly of such a magnitude as to be reflected in compensatory readjustments of the skeletal parts of a degree sufficient to influence significantly the posture score. If we postulate that standing is movement upon a stationary base, it follows a priori that instantaneous criteria of stance are fallacious in principle. The object of this study was to determine whether the insensible postural readjustments associated with every involuntary change in the location of the center of gravity are large enough to invalidate posture tests based upon isolated photographic observations.

Methods

The procedures employed are those described in detail in the earlier papers of this series.[4] In principle they consist of serial biplane posture photography synchronized with continuous biplane center of gravity observations.

Photographic observations were made at five second intervals during five minutes of uninterrupted standing. Letting the first picture mark zero time, each experiment thus yielded 122 photographs, 61 taken in each of the vertical orientation planes. To protect the eyes from the glare of flood lights and to reduce reflex variations in tonus moving over afferent channels connected with the retina to their approximate daylight normal, the subject wore the closely fitted glasses used in the Physical Therapy Clinic during ultraviolet irradiation. The eyes were kept open and the subject assumed either the best posture attainable by strong conscious effort or stood in a comfortably relaxed and natural stance. The subject looked at and beyond the flannel photographic backdrop, being careful not to fix the gaze. To allay any discomfort from the heat of the flood lights, two electric fans were turned on the subject.

The period of standing was arbitrarily set at five minutes. A "good posture" which cannot be maintained for this length of time can have little utilitarian importance. Fixed and rigid postures are rapidly prostrating due to the inability to get adequate quantities of blood to the vital head-end of the vertical organism in consequence of the nullification of the accessory pump action of the antigravity muscles. The healthy young adult can withstand "gravity shock" for well over one-half hour. Five minutes of standing in "good posture" was thus deemed a safe period for observation, precluding syncope in normal subjects. The relaxed and comfortable stance is practically indefatigable. It can be maintained economically for relatively long periods of time with no appreciable discomfort.[5]

The experiments were performed on seven adult women ranging in age from the early twenties to the end of the fourth decade. Six

From the Department of Physiology, University of Wisconsin, Madison, Wisconsin.
Supported in part by funds from the Wisconsin Alumni Research Foundation.

were teachers or students of physical education and the seventh was a medical student with considerable experience in a variety of sports. As a group they were above the average in neuromuscular development and posture training. All were familiar with the technics of the experiment and the personnel administering the tests.

Control observations were run with the subject standing upon a virtually immobile platform constructed to fit over the center of gravity unit. This enabled an exact duplication of the experimental procedure standing on the two types of supporting plane. The control observations were made because the method employed for the determination of the center of gravity depends upon the use of two platform scales, known to have a deflection for full capacity of 100 lbs. of 0.156 in. At the lever distances effective in our experiments, the average maximum variation in scale load due to involuntary changes in the center of gravity produces a platform deflection of approximately 0.006 in. and probably rarely exceeds 0.023 in. in the most unstable subjects. Though small, this movement of the supporting plane upon which the subject stands may have physiological significance. It is common experience, for example, that a heavy motor vehicle produces a tremor which is clearly perceptible even when standing on the floor of a well constructed building. It was necessary, therefore, to ascertain whether the postural sway under study is a normal physiological phenomenon or an artefact related to the instability of the supporting platform upon which the subject must stand if center of gravity determinations are to be made.

The control observations were limited to two minutes and always were made with the subject standing in a relaxed and comfortable posture. Thus each series of observations was composed of three parts: five minutes of standing in the best posture attainable, a like period during which a natural pose was allowed, and two minutes of normal standing upon the stable platform. The subject dismounted from the apparatus between each part of the experiment and was permitted to move about at will until he was ready to carry out the next procedure. The order in which the parts were administered varied with the different subjects to take into account any unforeseen elements of fatigue or boredom.

Of the many methods of evaluating posture, the Wellesley Test of MacEwan and Howe is one of the most precise and carefully constructed. It has been extensively used, especially as a research device. This test was therefore taken as the criterion by which to judge the influence of sway upon posture, using it as an excellent example of the instantaneous photographic technic. The method has been fully described in this journal[6] and elsewhere.[7] It is unique in that the obstruction of salient vertebral column contours by the scapulae, rib flare or bulky muscle masses, and of the sternum by the breasts, is effectively alleviated by affixing light aluminum pointers of uniform known length to the skin overlying specified skeletal prominences. By standardizing the placement of the subject in relation to the camera, disregarding postural sway, a reduction factor may be obtained from which the expected length of the pointer can be calculated. The visible portion of the pointer then serves as a guide for the location of the hidden end attached to the skin, thus making the important dorsal and lumbar spinal curves and the sternum subject to quite accurate observation. Using a carefully standardized technic and precision instruments, certain guide points and lines are introduced on the profile photograph, which, when examined with the aid of a magnifying glass under transillumination against a transparent triple scale, permits a numerical evaluation of the anteroposterior curvatures of the upper and lower back, the head and chest poise, abdominal contour and body tilt.

The experiment yielded a total of 2008 photographs. This study is limited to an analysis of the 1004 taken in the sagittal plane, since no suitable objective method exists for the quantitative evaluation of the posture viewed from the back. All the photographs were measured by one of us (K.S.R.) whose reliability in the use of this technic was studied carefully. Since the grading of the posture pictures was of necessity spread over a period of months, the initial reliability of the operator used to denote acceptable mastery of the technic was held as a standard for comparison throughout the experiment by the insertion of a test photograph between approximately every 12 pictures to be graded. In all, 109 copies made from one film positive were graded in the measurement of the experimenter's reliability. The Wellesley Test affords multiple opportunities for error, both in the preparation of the photographs for measurement and in the reading of the triple scale.

The precautions taken do not account for errors in dimensions introduced by the swaying of the subject away from and toward the camera. The aluminum pointers attached to the skin over the spinous processes and the sternum are as-

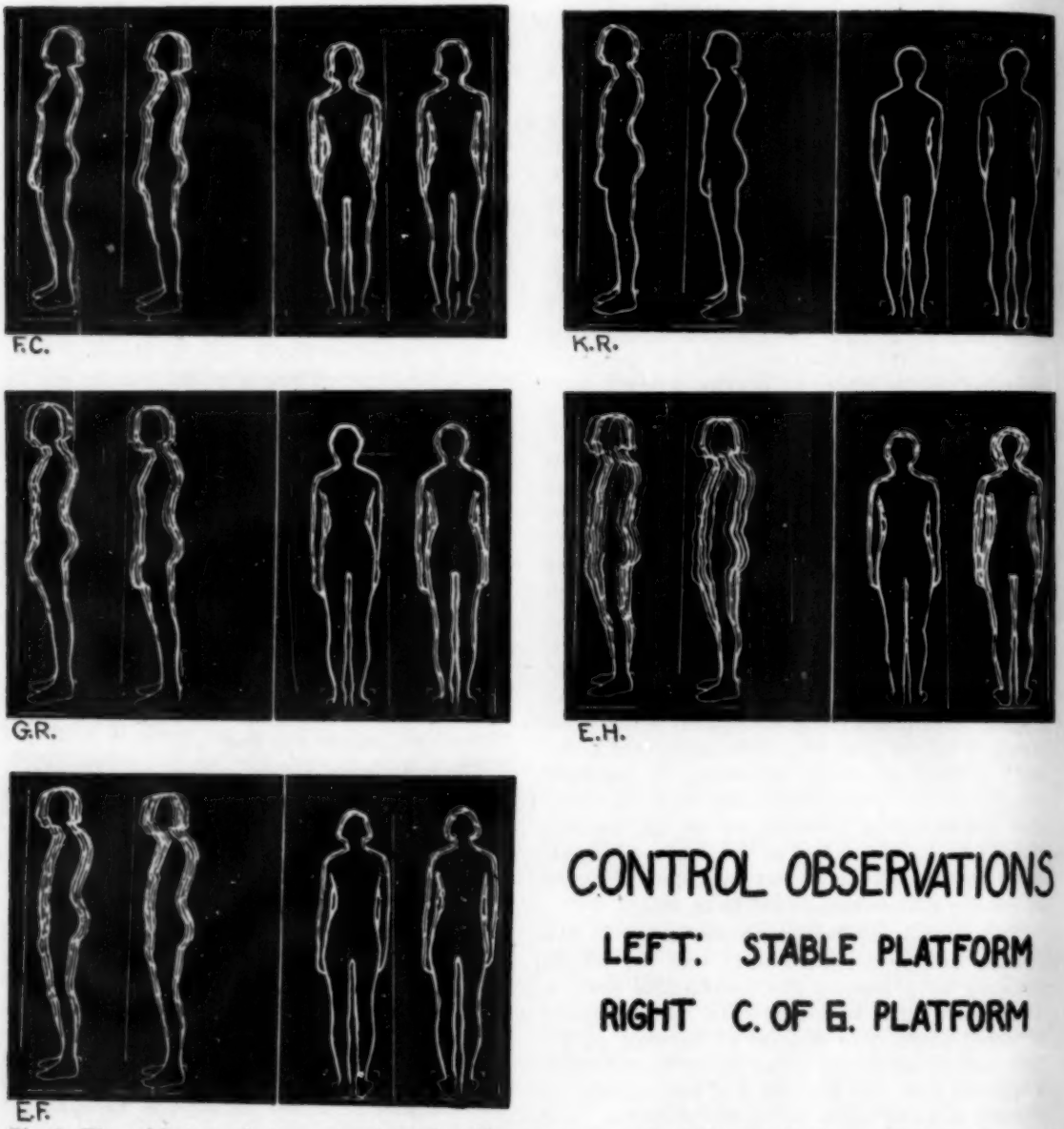


Fig. 1. *The subject stands in a natural comfortable posture on each of the two platforms. Photographs were taken at five sec. intervals for two minutes. Each figure in the illustration is a sketched composite of* 25 *serial pictures.*

sumed to have a constant length in the photographs. That this is erroneous is familiar to any careful observer. The photographic images of the pointer appear at times to have been so elongated that the attached leg falls short of the visible contours of the physical body. Conversely, they are foreshortened when the subject sways away from the camera. However, direct measurements on a mechanical device made to simulate degrees of sway toward and away from the camera of a magnitude commonly met with in normal subjects show that these errors are, in the vast majority of cases, smaller than the accuracy of the method and can be safely disregarded.

RESULTS AND THEIR INTERPRETATION

1. *Control Observations*: Figure 1 permits a

TABLE I

Control observations showing the variability in the Wellesley Posture Score of 25 successive observations made at five second intervals standing in a natural and comfortable posture on the center of gravity apparatus and on a stable platform.

	Center of Gravity Apparatus				Stable Platform				Difference		
Subject	M	∂	V	∂M	M	∂	V	∂M	D	∂D	CR
F. C.	16.32	.95	5.83	.19	20.32	1.18	5.83	.24	4.00	.31	+12.90
G. R.	14.32	1.64	11.44	.33	16.44	1.57	9.54	.31	2.12	.45	+ 4.71
E. L.	14.80	.45	3.02	.09	12.90	.76	5.90	.15	1.90	.17	—11.18
K. R.	20.60	.97	4.72	.19	20.36	1.37	6.75	.27	.24	.33	— 0.73
E. F.	27.24	1.41	5.19	.28	27.16	1.09	4.00	.22	.08	.36	— 0.22
E. H.	21.16	1.85	8.76	.37	21.54	1.20	5.56	.24	.38	.44	+ 0.86

M=mean; ∂=standard deviation of the distribution; V=coefficient of variation; ∂M=standard error of the mean; D=difference between the means; ∂D=standard error of the difference; CR=critical ratio.

ready comparison of the degree of postural instability occurring while standing for two minutes in a natural, easily erect posture on the center of gravity and on the stable platforms. That there is no decisive difference between the variability of the two is easily seen. The data presented in Table 1 confirm the evidence contained in the series of superimposed photographs. For example, if the standard deviations are compared, it can be seen that the dispersion of the test scores may be greater or less when standing on one platform than when standing on the other. The posture may be better or worse, or relatively unchanged. It appears, then, that the slight instability in the surface with which the soles of the feet make contact when standing upon the center of gravity platform does not alter postural sway in any statistically significant way and may be dismissed for the purposes of this study.

2. *Reliability of the Scorer*: An estimate of the consistency with which the experimenter gets the same score when copies of the same picture are graded may be obtained from a study of Table 2. The two series of reliability data are essentially similar, suggesting that they represent the irreducible errors of an observer exercising more than ordinary care. Inattention was meticulously guarded against by limiting the number of daily observations. There was no haste and the work was done in a quiet laboratory.

The measurements of the depth of the lumbar lordosis and of body lean were the most variable. They are so small to begin with that errors in estimating fractional portions of one division on the triple scale have relatively great significance. The numerical grade ranges from 0 to 25. The lower the number the better the posture. Five points are assigned to each letter grade. Thus the subject used for the study of the reliability of the grader had a B+ posture.

In the original paper of MacEwan and Howe,[7] the precision of the Wellesley Test was very

TABLE 2

Showing the variability in the partial and total Wellesley Posture Scores assigned to copies of the same photograph graded repeatedly by one observer.

	Initial reliability*			Current reliability+		
	M	∂	V	M	∂	V
Position of upper back	8.06	.22	2.67	8.72	.49	5.63
Position of lower back	2.20	.45	20.35	2.27	.62	27.21
Body lean	1.52	.36	23.68	1.57	.39	24.91
Head poise	—5.22	.45	8.60	—5.36	.37	6.93
Total score	6.52	.61	9.32	6.74	.63	9.29

* 25 Observations + 84 Observations

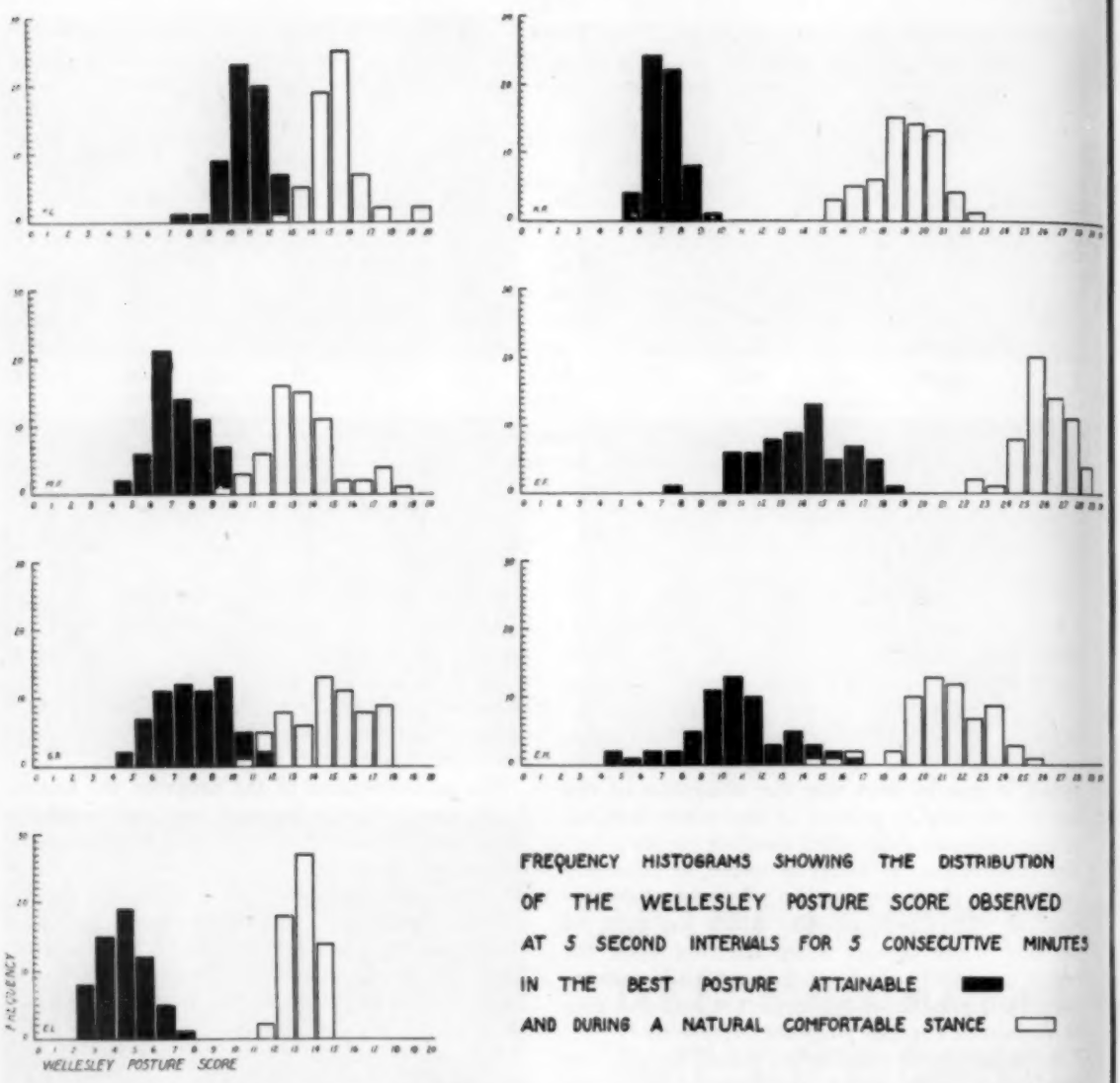

FREQUENCY HISTOGRAMS SHOWING THE DISTRIBUTION
OF THE WELLESLEY POSTURE SCORE OBSERVED
AT 5 SECOND INTERVALS FOR 5 CONSECUTIVE MINUTES
IN THE BEST POSTURE ATTAINABLE
AND DURING A NATURAL COMFORTABLE STANCE
FREQUENCY
WELLESLEY POSTURE SCORE

Fig. 2. The Wellesley Posture Score ranges from 0 to 25. The lower the score the better the posture. The test was developed for application to subjects in comparatively fixed postures approaching the best attainable. Relaxed and comfortable stances are so much poorer that it was necessary to extend the scale arbitrarily.

carefully studied. An effort was made to separate the variability of the posture itself from the reliability of the technic. We have further differentiated between these sources of inconstancy by measuring the accuracy of the grading procedure alone. Thus at the onset of the experiment, the scorer (K.S.R.) was precise in her assignment of grades to copies of the same posture picture to within .48 of a unit on the numerical scale and .096 of a letter grade. She was accurate to within ±1.92 per cent. During the course of the experiment, when she was grading more than 1000 pictures, she was precise to .36 on the numerical scale and .072 on the letter grade scale, giving her an accuracy of ±1.44 per cent. This compares very favorably with the observations of MacEwan and Howe, indicates that the technic is within the reach of an untrained but careful observer, and that this criterion has a sufficiently high accuracy to differentiate between small variations in posture.

3. *Variability of the Wellesley Posture Score*: If every shift in the center of gravity which occurs involuntarily during standing entails readjustments of the skeletal segments and if the Wellesley Test measures minute changes in stance, then it follows that the posture score must vary from moment to moment. Figure 2 illustrates this in the form of frequency histograms of the distribution of the scores obtained by each of our subjects when standing in "good" and in a natural comfortable posture. All of the curves are sensibly gaussian. They demonstrate strikingly that the concept of a *physiological constant* is applicable without question to the complex phenomenon which we call posture.

TABLE 3

Self-correlations showing the reliability of the Wellesley Test when 61 determinations are made in quick succession standing either in the best posture attainable by strong voluntary effort or in a natural comfortable stance.

	Best Posture	Natural Stance
Subject	r	r
F. C.	.28	.32
M. F.	.35	.77
G. R.	.60	.66
E. L.	.62	.33
K. R.	.40	.71
E. F.	.54	.12
E. H.	.46	.51

The reliability of the Wellesley Test as administered in these experiments was estimated by the split-half method of self-correlation. The results are presented in Table 3. For the best possible stance the average coefficient was .464; for natural and comfortable standing, .488. The reliability of the test is about the same for the two types of standing, a point born out in Table 5 as well as in the histograms. Studying the two coefficients for each individual subject shows that sometimes the value is higher in the best posture, at others in the relaxed stance. The extremes were .12 and .77. Glassow summarizes the scant reliability data in the published literature on posture.[8] Presumably all of these were derived by the repetition of the test, each of the two trials being limited to a single instantaneous stance photograph with the subject standing in his best posture. Her observations yield coefficients never attained in our series of experiments. It is probable that when a subject "gets set" for a single posture picture, the pose, momentarily held, is more consistent than the stance observed successively during more prolonged periods of observation.

It is difficult to escape the conclusion that posture is by no means consistently repeatable. The low reliability of the MacEwan-Howe test is due to no defect in the procedure. It merely reflects what was predicted a priori—that since the center of gravity shifts incessantly this must be associated with continuous readjustments of the multijointed, living, mobile body. In fact, it would be difficult to explain constancy in the score yielded by so precise and accurate a procedure as the Wellesley Test. The evidence reaffirms the weakness of attaching any explicit diagnostic significance to a single posture picture. The posture grade must be accepted with the same reservation with which the clinician views a single blood count, kidney function test, basal metabolic rate or heart size determination. He thinks in terms of the probability with which the numerical data indicate a normal or pathologic state, allowing ample leeway to account for biological variation.

We have shown that the error in grading posture by the Wellesley Test amounts to ±1.44 per cent. The average deviation in posture score of one of our steadiest subjects (K.R., see Fig. 1) yielded a percentage variability of ±2.88, which is twice the inherent error in the technic. Her mean posture score was 7.8, precise to .72 on the numerical scale and .14 on the letter grade scale. One of our least steady subjects (E.F.), with a mean score of 14.67 in her "best" posture, showed a variability of ±7.36 per cent and a precision in the grading of 61 successive pictures of 1.84 points on the numerical scale and .368 on the letter grade scale. This evidence is in keeping with experience in the study of physiological phenomena. They are never exactly repeatable. It is common practice to allow deviations of ±10 per cent for biological variation. Applied to the MacEwan-Howe Test, physiological variability can account for a full letter step difference in grade. There is no way of telling when confronted with a single score whether this falls in the region of the mode of that subject's frequency distribution could the test be repeated many times, or at one or the other extreme. How one stands is the resultant of a complex network of intricate physiological mechanisms, interrelated and mutually compensatory, every one of which is variable. Normal standing must be variable. Constancy in posture score may mean that the differentiating test is a coarse one, or it may mean that what is being studied is not a normal

physiological process but some artificial pose, repeatable by voluntary effort.

MacEwan and Howe made half-hourly observations on a loose-jointed, poorly coordinated and easily fatigued subject, until 15 posture pictures had been taken. It is interesting to note that the average deviation from this subject's mean score was 1.62 on the numerical scale. This variability was attributed to the combined effect of the day's cumulative fatigue and the repeated affixing of the pointers. Our evidence suggests that approximately the same results probably would have been obtained if the 15 observations had been made successively as in our experiments. Subject E. F. in our series was asthenic in habitus and easily developed "gravity shock." When observed 61 times in five minutes, her average deviation from the mean score was 1.84. Subject E. H., who also swayed excessively, both in her "best" and in her relaxed posture, had an average deviation of 1.5 when standing on the stable platform for two minutes. Her superimposed photographs are included in Figure 1. MacEwan and Howe reasoned that successive posture pictures would eliminate cumulative fatigue and certain errors in technic and thus would measure the variability of posture itself plus the reliability of grading. Curiously enough they selected for this crucial test a shorter, more compactly built and better coordinated subject than the one already cited. The average deviation from the mean score was now only .90 on the numerical scale and .18 of a letter step. Our evidence suggests that the difference in results is one of physiological variability rather than the alleviation of fatigue or the nullification of errors in technic. Our subject F. C. was short and stocky in build. When standing on the stable platform for two minutes as illustrated in Fig. 1. her average deviation from a mean score of 18.88 was .93 on the numerical scale and .186 of a letter step.

4. *Comparison of the Influence of Postural Sway on the Best Stance Attainable by Voluntary Effort and on Relaxed and Comfortable Standing*: When this experiment was set up it had as one of its incidental objectives the evaluation of fatigue induced by the two types of standing under study. A pliant young adult with good neuromuscular development and muscle-joint sense can voluntarily produce a very appreciable change in his body alignment. We were interested in knowing whether such forced redistribution of the body parts is a thing which can be held more than momentarily. The mean total score for each minute of standing was therefore calculated. The results are presented in Table 4. There is no suggestion in this data that either of the two stances under study deteriorates significantly as a consequence of whatever fatigue may be attached to the resultant effort. The tonus supplying the equilibrating

TABLE 4

The average Wellesley Posture Score during each of five consecutive minutes of standing in "good" posture and in a natural stance. Observations were made at five second intervals.

Subject	1st minute	2nd minute	3rd minute	4th minute	5th minute
Best Posture Attainable by Voluntary Effort					
F. C.	12.04	11.73	11.88	11.38	10.92
M. F.	6.88	7.35	7.65	7.91	8.96
G. R.	8.00	7.58	8.08	7.81	7.77
E. L.	5.96	5.25	4.64	4.62	5.00
K. R.	9.18	7.73	7.31	7.58	7.69
E. F.	12.19	14.42	14.65	15.27	17.08
E. H.	9.29	10.19	11.46	12.88	12.15
Natural Comfortable Posture					
F. C.	15.58	16.19	15.58	15.50	17.04
M. F.	12.61	13.19	14.65	14.31	16.65
G. R.	12.54	13.65	15.31	17.35	16.58
E. L.	14.73	14.50	14.08	13.58	13.77
K. R.	21.15	20.85	20.15	18.08	18.92
E. F.	25.73	26.92	27.42	26.31	26.31
E. H.	19.92	22.23	23.04	23.42	20.96

TABLE 5

A comparison of the influence of postural sway on the best stance attainable by voluntary effort and on a relaxed and natural stance.

		Best Posture					Natural Stance					Difference		
	P	N	M	∂	V	∂M	N	M	∂	V	∂M	D	∂D	CR
F. C.	U.B.	61	4.70	.73	15.53	.093	60	5.71	.65	11.38	.084	1.01	.125	8.07
	L.B.	61	6.29	.67	10.65	.086	60	6.39	.58	9.08	.075	.10	.113	.88
	B.L.	61	3.02	.58	19.21	.074	60	4.41	.63	14.29	.081	1.39	.110	12.64
	H.P.	61	—2.43	.41	16.87	.052	60	—0.47	.44	93.62	.057	1.96	.077	25.52
	T. S.	61	11.57	.97	8.38	.124	60	16.03	1.18	7.36	.152	4.46	.196	22.71
M. F.	U.B.	61	4.67	.90	19.27	.115	61	7.33	.85	11.61	.109	2.66	.158	16.79
	L.B.	61	.45	.63	140.00	.081	61	.68	.80	117.65	.102	.23	.130	1.77
	B.L.	61	3.98	.47	11.81	.060	61	4.96	.41	8.27	.052	.98	.079	12.36
	H.P.	61	—1.20	.54	45.00	.069	61	1.35	.57	42.22	.073	2.55	.100	25.40
	T. S.	61	7.94	1.28	16.12	.164	61	14.52	1.85	12.74	.237	6.58	.288	22.86
G. R.	U.B.	60	9.19	.79	8.60	.102	61	11.52	.72	6.25	.092	2.33	.137	16.96
	L.B.	60	2.07	.57	27.54	.073	61	1.98	.53	26.77	.068	.09	.100	.90
	B.L.	60	1.68	.78	46.43	.101	61	3.24	.82	25.31	.105	1.56	.145	10.74
	H.P.	60	—4.34	.85	19.59	.110	61	—1.25	.77	61.60	.098	3.09	.147	20.98
	T. S.	60	8.63	1.66	19.24	.214	61	15.48	1.87	12.08	.239	6.85	.321	21.34
E. L.	U.B.	58	1.45	.61	42.30	.080	61	5.21	.47	9.02	.060	3.76	.100	37.60
	L.B.	58	4.40	.56	12.73	.073	61	4.16	.39	9.37	.050	.24	.089	2.70
	B.L.	58	1.06	.56	52.83	.073	61	3.61	.42	11.63	.054	2.55	.091	27.99
	H.P.	58	—1.80	.37	20.56	.048	61	1.17	.29	24.79	.037	2.97	.062	48.21
	T. S.	58	5.10	1.11	21.76	.146	61	14.15	.75	5.30	.096	9.05	.174	51.92
K. R.	U.B.	59	5.88	.37	6.29	.048	61	9.33	.82	8.79	.105	3.45	.115	29.92
	L.B.	59	7.31	.78	10.67	.101	61	7.98	.56	7.02	.072	.67	.124	5.40
	B.L.	59	.88	.60	68.18	.078	61	3.60	.69	19.17	.088	2.72	.118	23.09
	H.P.	59	—6.19	.62	10.02	.081	61	—1.17	.59	50.43	.075	5.02	.110	45.47
	T. S.	59	7.88	.90	11.42	.117	61	19.81	1.43	7.22	.183	11.93	.217	54.93
E. F.	U.B.	61	10.93	.89	8.14	.114	61	14.27	.65	4.55	.083	3.34	.141	23.69
	L.B.	61	3.58	.69	19.27	.088	61	3.73	.61	16.35	.078	.15	.118	1.27
	B.L.	61	2.00	.93	46.50	.119	61	5.43	.67	12.34	.086	3.43	.147	23.40
	H.P.	61	—1.91	1.12	58.64	.143	61	3.39	.52	15.34	.066	5.30	.158	33.54
	T. S.	61	14.67	2.27	15.47	.291	61	26.81	1.30	4.85	.166	12.14	.335	36.26
E. H.	U.B.	60	8.15	.83	10.18	.107	61	12.31	.98	7.96	.125	4.16	.165	25.27
	L.B.	60	1.62	1.04	64.20	.134	61	1.97	.77	39.09	.098	.35	.166	2.10
	B.L.	60	3.16	.90	28.48	.116	61	5.96	1.23	20.64	.157	3.12	.196	15.94
	H.P.	60	—1.61	.94	58.38	.121	61	1.60	.69	43.12	.088	3.21	.150	21.40
	T.S.	60	11.32	2.56	22.61	.330	61	21.84	2.09	9.57	.268	10.52	.425	24.75

P=posture; U.B.=upper back; L.B.=lower back; B.L.=body lean; H.P.=head poise; T.S.=total Wellesley Score.

forces for gravitational stresses is cheap in contrast with the cost of phasic muscular contractions. The fatigue of standing is rarely of metabolic origin. We have postulated that it is more probably due to cerebral anoxia.[5] The transitory nature of our experiments precluded any difference in response of this origin, although theoretically the less mobile "A" posture is more syncope-producing than a freely relaxed stance and is associated with more subjective discomfort.[9]

That significant differences in posture may be attained by conscious effort receives numerical support in Table 5. Although the posture is

"worse" in the natural stance than in the artificial one, its relative variability is uniformly less marked. The two parts of the Wellesley Test graded with the least accuracy (Table 2) show the smallest critical ratios. The lower back score is significantly different in the two types of standing in only one out of the seven subjects. Of the parts of the test, head poise changes the most when the "best" posture gives way to a more natural stance.

SUMMARY AND CONCLUSIONS

The normal variability of posture due to involuntary body sway has been studied in seven young adult women. Each subject stood in her "best posture" on the center of gravity platform for five minutes and again for the same time in a natural comfortable stance. Photographs were taken at five sec. intervals yielding 1004 profile pictures which were graded by the MacEwan-Howe method. The evidence presented substantiates the following conclusions:

1. The Wellesley Posture Test is accurate to ±1.44 per cent and is capable of detecting small differences in alignment.

2. The minute instability of the center of gravity platform does not significantly affect postural sway.

3. The photographic criterion of stance selected indicates that posture is a variable phenomenon.

4. Repeated observations fall on a normal probability curve.

5. Natural comfortable standing receives a significantly poorer score than the best posture attainable by voluntary effort but is somewhat less variable.

6. Posture does not deteriorate significantly in five minutes of time.

7. The data suggest that the involuntary shifts in the center of gravity known to occur during standing are associated with compensatory attitudinal changes of a magnitude sufficient to give limited diagnostic value to single instantaneous observations of posture.

Acknowledgements: We wish to thank Miss Charlotte G. MacEwan of Wellesley College for the gift of a MacEwan-Howe Triple Scale, and Dr. Helen D. Denniston of the Department of Physical Education, University of Wisconsin, for the loan of Wellesley pointers.

BIBLIOGRAPHY

1. Hellebrandt, Frances A.: Standing as a Geotropic Reflex; the Mechanism of the Asynchronous Rotation of Motor Units. Am. J. Physiol. 121: 471-474, February 1938.
2. Hellebrandt, Frances A. and Genevieve L. Braun: Influence of Sex and Age on the Postural Sway of Man. Am. J. Phys. Anthrop. 24: 247-360, Jan.-March 1939.
3. Hellebrandt, Frances A., Eleanor Fielding Crigler and L. E. A. Kelso: Variations in Intramuscular Pressure during Postural and Phasic Contraction of Human Muscle. Am. J. Physiol. 126: 247-253, June 1939.
4. Hellebrandt, F. A., L. E. A. Kelso and E. Corinne Fries: Devices Useful to the Physiological Study of Posture. Physio. Rev., 22: 1:10, Jan.-Feb. 1942; Hellebrandt, F. A. and L. E. A. Kelso: Synchronizing Biplane Stance Photography with Center of Gravity Observations. Physio. Rev., 22:2, Mar.-Apr. 1942.
5. Hellebrandt, F. A., Elizabeth Brogdon and Rubye H. Tepper: Posture and Its Cost. Am. J. Physiol. 129: 773-781, June 1940.
6. MacEwan, Charlotte G., Elizabeth Powell, Eugene C. Howe: An Objective Method of Grading Posture; its Development, Routine Procedure and Applications. Physiotherapy Review, 15: 167-173, Sept.-Oct. 1935.
7. MacEwan, Charlotte G. and Eugene C. Howe: An Objective Method of Grading Posture. Research Quart. 3: 144-157, October 1932.
8. Glassow, Ruth B. and Marion R. Broer: Measuring Achievement in Physical Education. W. B. Saunders Co. Philadelphia, Pennsylvania, 1938.
9. Hellebrandt, Frances A. and Elizabeth Brogdon: Hydrostatic Effect of Gravity on the Circulation in Supported, Unsupported, and Suspended Postures. Am. J. Physiol. 122: 95, July 1938; Brogdon, Elizabeth and Frances A. Hellebrandt: Postural Changes in Respiration. Am. J. Physiol. 126: P445, July 1939.

Simple Workable Respirator

Report of Council on Physical Therapy

An epidemic of poliomyelitis of major proportions struck the Northern peninsula of Michigan in the fall of 1940. Within a period of a few days 90 patients were rushed by train, by automobile and even by airplane into St. Luke's Hospital at Marquette, Mich. The respiratory type of paralysis was unusually prevalent among the affected children. Only one respirator was available, and at least 12 children needed assistance.

The superintendent of St. Luke's Hospital appealed to Mr. M. K. Reynolds, one of the trustees, for help, insisting that with his engineering ability he surely could devise some type of temporary respirators that could meet the problem until regular respirators could be obtained. The machine shop which Mr. Reynolds maintained at his private boat yard immediately was turned into a respiratory laboratory. Cabinet makers and machinists were called in and within a few hours crude but workable respirators were delivered to the hospital. Their first homemade respirator consisted of two gasoline drums welded together and fitted with a hand manipulated valve; this apparatus was attached by a hose to the one available large respirator as a "trailer." Two children were placed in this "trailer," and women of the community worked the valve by hand constantly for thirty-six hours, or until a

Reprinted from J.A.M.A., 118:7:535, Feb, 14, 1942.

mechanical automatic valve was constructed. The thrilling story of this volunteer community effort to meet the respiratory problem when commercial respirators were not available was published in the December 1940 issue of *Hygeia*.

Since that article was published, Mr. Reynolds has received numerous letters and many personal visits from representatives of remote communities where poliomyelitis has broken out and where the respiratory problem has become as acute as it was in Marquette. For example, an epidemic has been raging in Alaska. Respirators were needed. An appeal came to Mr. Reynolds and he sent photographs and working plans for making this simple wooden respirator which had proved so valuable in the Marquette epidemic. In his opinion these respirators could be made within a few hours in any school manual training shop, should the emergency arise.

That there is a great need for emergency respirators was recognized by Drs. Phillip Drinker and Edgar Roy, who published specifications for making such an apparatus in the *Journal of Pediatrics* (13:71, July 1938.) This need is also evident from the urgent requests which have come to the office of the Council during the past year from various parts of the country asking for information as to the location of available respirators. The National Foundation for Infantile Paralysis on July 1, 1941, published a complete list of respirators, giving locations and owners, which may be obtained from the foundation at 120 Broadway, New York City.

It has long been recognized that the need for respirators arises in time of great emergency and that commercial respirators are not always available when needed. Furthermore, a simple respirator such as this should prove useful for intermittent home use to a limited number of badly paralyzed patients who have been hospitalized for many months. Since the respirator can be built cheaply, it can meet an economic problem heretofore almost unsurmountable for patients who require prolonged assistance of a respirator.

Mr. M. K. Reynolds has given to the Council on Physical Therapy a complete set of drawings with instructions for building this simple workable respirator. A pamphlet which graphically sets forth its construction has been prepared and is available for distribution on application to the Council on Physical Therapy of the American Medical Association. This pamphlet should enable any community far removed from a supply of commercial respirators to build this life saving device.

The Council on Physical Therapy has reviewed the plans for making this simple wooden respirator and has authorized the publication of this pamphlet. We feel that Mr. Reynold's gift to humanity merits the gratitude of the entire profession.

Vapor Bath Apparatus:

Invented by Dr. Louis H. Lefebvre

William Dosite' Postell, B.S., M.S., B.S. in L.S.

'Probably one of the most interesting phases of medical history, at least from the local standpoint, is that type of medicine which was practiced on the old slave plantations prior to the War between the States. Miss Mary Louise Marshall inaugurated investigative work along this line in 1938 with her article on "Plantation Medicine,"[1] which appeared in the *Bulletin of the Medical Library Association.*

I became interested in this phase of medical history and visited some of our old plantation homes this past summer to see if there were any remnants of this most interesting phase of medical history.

One of the homes visited was the Prudhomme home south of Natchitoches, Louisiana, at Bermuda. This home, according to its owners, was built in 1822 and is typical of the homes built at that time, having the lower front gallery pillars of brick and the second story of wood. The Prudhomme's maintain a museum in the first story of their home, containing all the tools, equipment and implements that were in use on the plantation during slaveholding days. Among

Librarian of the Louisiana State University School of Medicine, New Orleans, La.

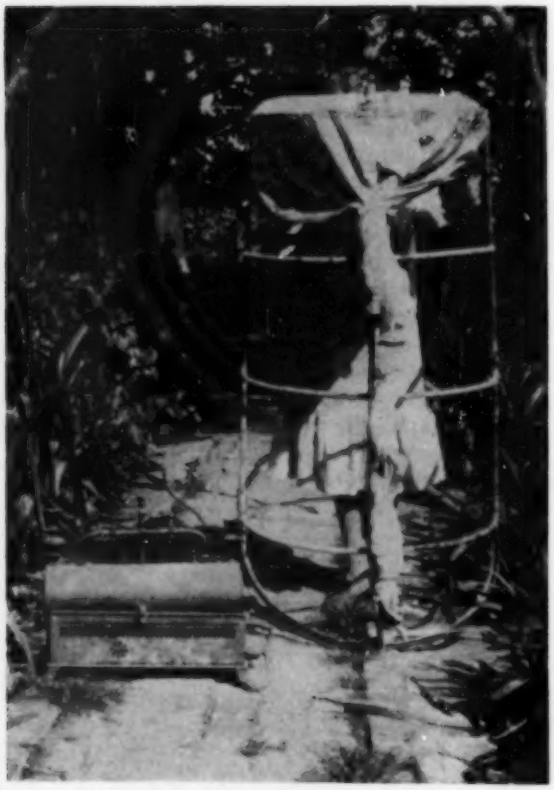


Fig. 1. Boiler and metal frame of the Vapor Bath in the museum of the Prudhomme home, Natchitoches, La.

the museum pieces was an interesting looking apparatus, containing a small boiler and a large metal frame, with a piece of canvas still clinging to the metal frame. Fortunately the canvas contained the name and inventor of the apparatus. The inscription read thus: "Vaporiferous Apparatus. Dr. L. H. Lefebvre. Pat. Aug. 18 ." However, no information could be secured from the owners as to its use or purpose. A photograph of the apparatus was taken (Figure 1) showing the small boiler and the metal frame which is being held in an upright position.

Upon returning to New Orleans a search was made through the medical journals of that period to see if there was any mention of a "Vaporiferous Apparatus," and under the heading "List of pamphlets received" in the *New Orleans Medical and Surgical Journal* for July 1857 was listed a pamphlet by Dr. L. H. Lefebvre entitled "Vaporiferous Bath Apparatus."[2]

A further search was made to see if a copy of this pamphlet was still in existence, all to no avail. An inquiry was sent to the United States Patent Office concerning this patent. Fortunately, the Patent Office was able to forward a copy of the patent issued to Dr. Louis H. Lefebvre of New Orleans for a vapor-bath apparatus (Patent No. 13,467, dated August 21, 1855).

A diagram of the vapor-bath apparatus is shown in Figure 2. In the opening paragraph Lefebvre made this statement:[3]

> "Be it known that I, Louis H. Lefebvre of New Orleans, . . . have invented a new and useful Apparatus for Administering Medicated and Vapor Baths, which I denominate a 'Steam-Bath-Bag Apparatus'; and I do hereby declare that the following is a full and exact description thereof, reference being made to the accompanying drawings, making part of this specification."

Lefebvre then describes the working of his "bath." Sulphur was placed in one compartment of the boiler and water in the other, and heat was applied. Sulfurous acid would then be generated. This gas would be conducted by a pipe or tube to the bag which was fitted tightly around the person to be treated.

Among the claims of the inventor for his "bath" was the successful treatment of cholera as stated in his patent:[4]

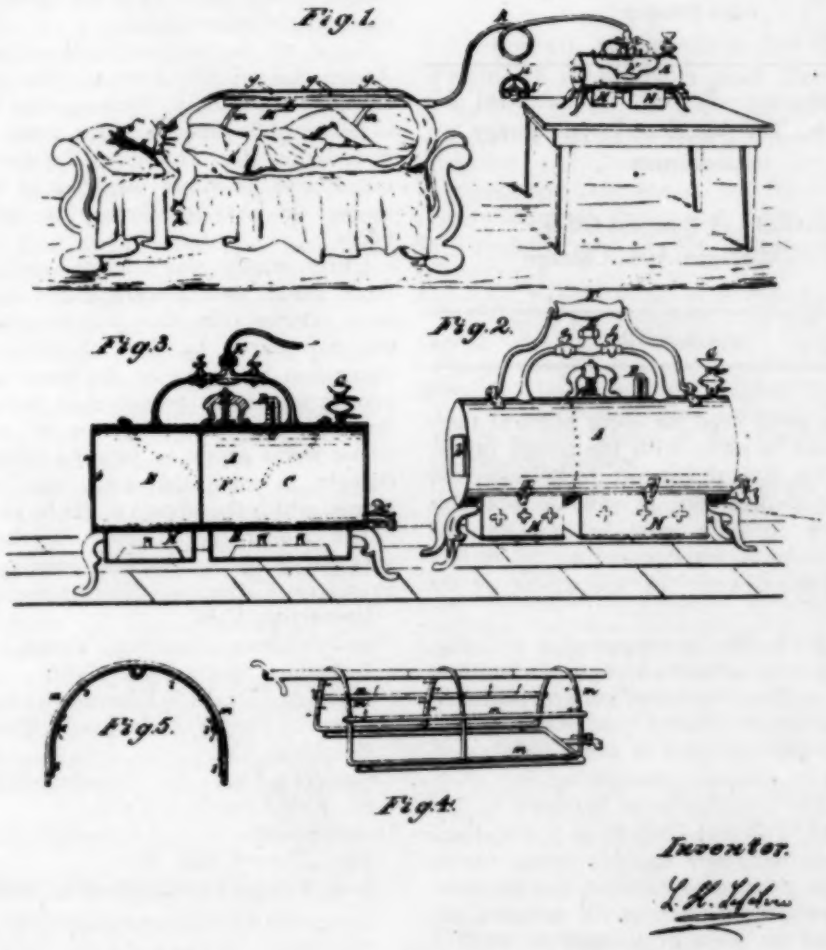
> "This apparatus is compact and portable; and may be used in administering every kind of medicated and vapor baths. It is especially valuable in treating cases of cholera, as I have proved by much successful experience. . . ."

An attempt was made to find something concerning the inventor, but very little was found. He was granted a license to practice medicine in Louisiana on May 30, 1832, on the presentation of his diploma from the University of Paris. He does not seem to have held membership in any medical societies of that time, as his name does not appear on any of their lists of members. A search through the medical journals of that day failed to reveal any articles written by him. And so it can be concluded that Doctor Lefebvre's sole contribution to medical science was his "Vapor Bath Apparatus." If it seems rather odd to us now, it at least was no better or no worse than many other strange inventions that were placed on the market at that time. After reading the description of the "bath" and what was expected from it, one can assume that the inventor was sincere in his belief that a great deal of good would be accomplished by his invention.

L. H. Lefebvre.

Vapor Bath.

No 13,467. Patented Aug. 21 1855.



Inventor.

L. H. Lefebvre

Fig. 2. Diagram of the Vapor Bath as contained in United States Patent No. 13,467.

BIBLIOGRAPHY

1. Marshall, Mary Louise: Plantation Medicine. Bull M. Library A. 26:115-128, Jan. 1938.
2. Dr. L. H. Lefebvre: Vaporiferous Bath Apparatus. New Orleans. The author, 1856. pp. 12. New Orleans M. & S. J. 14:143, July 1857.
3. Louis H. Lefebvre: Vapor-Bath Apparatus. United States Patent Office. Patent No. 13,467, August 12, 1855. p. 1.
4. Ibid. p. 2.

The
Physiotherapy Review

Editor-in-Chief: MILDRED ELSON

Business Manager: HAZEL PUTMAN

Associate Editors

GERTRUDE BEARD
BEULAH BURTNER
BESS SEARLS

The Physiotherapy Review is published bi-monthly by The American Physiotherapy Association

Editorial and Business Office,
737 N. Michigan Ave., Chicago

VOL. 22 *March-April* No. 2

There is a great need for more physical therapy technicians to serve with the armed forces, and we realize also that many technicians are necessary for civilian care. In order to meet this demand more students must be enrolled and trained. Our schools are "geared up" to do the job and we must keep the enrollment at its maximum.

Help our profession by encouraging and urging graduates from schools of physical education and students with two years of college, including twenty-six hours of science (courses in chemistry, physics and biology), to enroll in physical therapy courses. Anyone considering the study of physical therapy should be referred to the article entitled "Physical Therapy as a Vocation" which appears elsewhere in this issue, for it would give the prospective physical therapy technician a more definite idea of the personal requirements and the scope of physical therapy.

Nurses are needed by their own profession so for the present we must recruit students from these other sources. Make it your individual responsibility to procure one or more new students, and we cannot fail to provide our armed forces with the necessary technicians of physical therapy who are needed as a vital part of the rehabilitation of our wounded. We must all do our part.

Report of Nominating Committee

The Nominating Committee believes the entire membership will agree with us that this is an unusual and serious time in the history of the country and as such is reflected in the daily life and activities of every individual and group of individuals. Many of our members have entered Army service and local chapters have felt their loss in carrying out originally-planned programs. Our personal responsibilities have increased and these have multiplied up through the national organization.

Some of the responsibilities which face the Association at the present time are problems relating to National Defense, the study which is being made under a grant from the National Foundation for Infantile Paralysis, and the educational problems involved in the approved courses in physical therapy to meet changing needs.

Unfortunately there is no one in the areas from which new officers might logically have been selected who has had experience on the national board. In view of this situation, the suggestion has come to the committee that the present officers be requested to serve again, and that the two new directors to replace those whose terms expire in June be selected with the thought in mind that they will be a nucleus around which the officers might be chosen in 1944.

The Nominating Committee therefore submits the following slate for your approval.

President—Catherine Worthingham, Stanford University, Calif.

Vice-Presidents—Dorothy Young, 480 Menlo Oaks Dr., Menlo Park, Calif.
Betty A. Rice, 5160 Claremont, Oakland, Calif.

Secretary—Evelyn Anderson, 5 Rico Way, San Francisco, Calif.

Treasurer—Alice V. Gantzer, 245 Vicksburg St., San Francisco, Calif.

Directors—Mr. S. Paul Campbell, 2523 Mansfield Ave., Drexel Hill, Pa.
Jane Ewing, Kernan Hospital, Baltimore, Md.

Respectfully submitted,
JANE EWING
JESSIE STEVENSON
MARY DEATHERAGE, Chairman

February 18, 1942.

Alice V. Gantzer has been appointed to the position of Treasurer of the American Physiotherapy Association to replace Catherine Wallace who has been called for Army service.

William Dick Cutter, M. D.

In the death of William Dick Cutter on January 22, 1942, the American Physiotherapy Association lost a valued counselor and friend. In 1934 our Association was beset with many problems concerning educational standards. We had gone as far as we could alone, and we turned to the Council on Medical Education and Hospitals of the American Medical Association for advice. There we met Doctor Cutter who as Secretary of the Council was to be our very good friend for the next eight years. We were a small technical group serving the medical profession. Our problems, although monumental to us, were small compared to those of the American Medical Association. We felt humble and almost apologetic in asking the Council for aid. Doctor Cutter, in his kind, patient manner, put us at ease, listened, and advised. As a result the Council on Medical Education and Hospitals, in the latter part of 1934, undertook a survey of our schools, set up educational standards for such schools and published a list of those meeting requirements. Many of us do not realize the amount of work this entailed. Nor do we remember the hopeless state of our educational standards at that time. We have come to accept the present status as existing always.

We owe a great deal to Doctor Cutter, and we have strived to show our gratitude to him during his life by always cooperating to the utmost. There was never a problem too small for his attention. His kindliness, patience and understanding were an inspiration to all fortunate enough to know him personally. He never relaxed in his effort to elevate and maintain high standards in all medical education. His service to the American Physiotherapy Association is unmeasurable and we hope that we will always maintain the ideals which he established.

Correction: Emergency Courses

The list of schools approved for emergency courses in physical therapy as given in the January-February 1942 issue of the REVIEW was incorrect. Following is the correct list of schools approved by the Council on Medical Education and Hospitals of the American Medical Association for *emergency courses* in physical therapy:

Children's Hospital, Los Angeles
Stanford University
Northwestern University Medical School
Harvard University Medical School (includes Harvard University and Boston University, Sargent College of Physical Education, united into one course)
Mayo Clinic
University of Buffalo
Hospital for Special Surgery, New York City (formerly Hospital for Ruptured and Crippled)
D. T. Watson School of Physiotherapy

The 1942 list of schools approved for *regular courses* in physical therapy will appear in the May-June issue of the REVIEW.

American Association for Health, Physical Education and Recreation

The joint meeting of the Therapeutics Section of the American Association for Health, Physical Education and Recreation and the American Physiotherapy Association will be held at the Charity Hospital Auditorium, New Orleans, La., on Tuesday, April 14, 1942. The program is as follows:

Presiding: Loraine Frost, State University of Iowa; Chairman of the Therapeutics Section.
Address of Welcome: Dr. O. P. Daly, Director, Charity Hospital.
"Physical Therapy and the Present Emergency"—Dr. Nathan Polmer, New Orleans; Chairman of the Executive Council of the American Congress of Physical Therapy.
"The Needs of Physical Therapy in the Army Hospital"—Major T. L. Waring, M.C., La Garde Hospital, New Orleans.
Third speaker to be announced.
"Technic of Relaxation and Its Contribution to Physical Fitness"—Dr. Josephine Rathbone, Teachers College, Columbia University, New York City.
Luncheon: Jung Hotel, 1500 Canal Street. Louise Cobb, University of California, Berkeley, "The Physical Fitness Program for Civilian Defense."
Leader: Catherine Worthingham, Stanford University; President, American Physiotherapy Association.
Consultant: Dr. Guy Caldwell, Orthopedic Surgery, Tulane University, New Orleans.
"Feet for the Future"—Discussion demonstration.
Alice Gantzer, Physical Therapist, San Francisco Public Schools.
Mrs. Marion Roberts, Texas State College for Women, Denton.
Ruth Langley, Physical Therapist, Charity Hospital, New Orleans.
"Recent Research on the Early Treatment of Poliomyelitis"—Mrs. Billie L. Crook, Austin, Texas.

New England Society of Physical Medicine

The regular meeting of the New England Society of Physical Medicine was held in Boston, February 18, 1942.

Twenty-First Annual Conference of the American Physiotherapy Association

College Camp, Williams Bay on Lake Geneva, Wisconsin
June 28 to July 3, 1942

The Twenty-first Annual Conference will be held at College Camp, Williams Bay on Lake Geneva, Wisconsin, June 28 to July 3, 1942, with the Illinois and Wisconsin Chapters acting as hostesses.

College Camp is an outstanding conference and vacation center located on one of the most beautiful of inland lakes, Lake Geneva. The picturesque location, the extensive facilities for recreation and conference meetings, as well as the comfortable accommodations and delicious meals, bring thousands of conference and vacation guests every year to College Camp.

A very able program staff and an unusual range of facilities for recreation provide something of interest for everyone. Sunday services, musicales, lectures, movies, trips to nearby places of interest and many special features are included in the program. Almost every kind of outdoor activity is available to guests, with the 18 hole golf course and club house being one of the main attractions. Guests find it very convenient to have such a fine course on the grounds. The rates are reasonable and rental clubs may be had. Swimming, boating and fishing can be enjoyed by those who so wish. Be prepared for outdoor life. Slacks, shorts, low-heeled shoes or any informal attire will be all you will need.

This year, more than ever, it is important to attend the National Conference in order that you may be fully informed on timely war topics. There also will be additional discussions on infantile paralysis, relationships with allied organizations and other important subjects.

Williams Bay is easily accessible. It is situated about sixty miles northwest of Chicago and approximately half way between Chicago and Madison, Wisconsin. The cost will not be high, and the rates will be all inclusive as they were last year. Plan now to attend.

PROGRAM SCHEDULE

	SUNDAY June 28	MONDAY June 29	TUESDAY June 30	WEDN'DAY July 1	THURSDAY July 2	FRIDAY July 3
A.M. 8:00 10:00		Infantile Paralysis Treatment	Infantile Paralysis Treatment	Infantile Paralysis Treatment	Infantile Paralysis Treatment	Allied Council Panel
10:30 12:30		War Injuries	War Injuries	War Injuries	War Injuries	Business Meeting
12:30 2:00		Luncheon	Luncheon	Luncheon	Luncheon	Luncheon
P.M. 2:00 3:30	Registration	Applied Anatomy	Applied Anatomy	Applied Anatomy	Applied Anatomy	
3:30 6:00	Registration	Rest and Recreation	Rest and Recreation	Rest and Recreation	Rest and Recreation	
6:00 7:30	Get-together Supper	Dinner	Dinner	Dinner	Dinner	
7:30 9:30	Business Meeting	P. T. Schools C. C. Schools Allied Coun.	P. T. Schools C. C. Schools Allied Coun.	P. T. Schools C. C. Schools Allied Coun.	P. T. Schools C. C. Schools Allied Coun.	

SUNDAY, JUNE 28.

2:00—6:00 P.M. Registration.

6:00—Get-together Supper—Illinois and Wisconsin Chapters, Hostesses.

7:30—9:30 Business Meeting.

MONDAY THROUGH THURSDAY, June 29—July 2

8:00—10:00 A.M. *Physical Therapy Treatment in Infantile Paralysis.*

Discussion based on the results of the recent survey under a grant from the National Foundation for Infantile Paralysis.

Discussion leader: JESSIE L. STEVENSON, National Organization for Public Health Nursing, New York.

Consultant: DR. VERNE T. INMAN, of the University of California at Berkeley.

Other participants will be announced later.

10:30—12:30 *War Injuries.*

Discussion based on the most common types of war injuries in World War II, together with their physical therapy treatment.

Discussion leader: MILDRED ELSON.

Consultant: DR. JOHN S. COULTER.

Other participants will be announced later.

12:30—2:00 Luncheon.

2:00—3:30 P.M. *Applied Anatomy.*

DR. VERNE T. INMAN will discuss anatomy applied to physical therapy. DR. INMAN has done extensive work in applied anatomy, in which field he made a most interesting contribution to the 1941 Conference.

3:30—6:00 Rest and recreation. College Camp has extensive facilities for recreation. The Illinois and Wisconsin Chapters will organize these hours so that the members of the conference may take advantage of the opportunities offered.

6:00—7:00 Dinner.

7:00—9:00 *Crippled Children's Schools Section.*

This group requested the formation of a section last year. Their program will be announced later.

Chairman: IDA MAY HAZENHYER, Jahn School, Chicago.

Physical Therapy Schools Section.

The discussion will center around a preliminary report of the Survey of Course Content in Physical Therapy Schools.

Chairman: EVELYN ANDERSON, Stanford University

Allied Council.

The American Physiotherapy Association has asked representatives of organizations having similar problems to discuss matters of common interest and helpfulness. This group will report its deliberations to the entire conference on Friday morning.

Discussion leader: HAZEL FURSCOTT, National Relations Chairman, San Francisco.

FRIDAY, JULY 3, 1942

8:00—10:00 A.M. *Report from the Allied Council.*

This report will take the form of a panel discussion and will give opportunity for discussion from the floor.

Discussion leader: HAZEL FURSCOTT.

10:30—12:30 Business Meeting.

The all-inclusive rates for the Conference will be very reasonable and approximately the same as last year.

Graduate Program in Physical Therapy at Northwestern University Medical School

(Sponsored by the American Physiotherapy Association) July 6 to 24, 1942

Schedule of Classes

Human Physiology. Lecture and demonstration course on the physiology of muscle action, circulation, respiration, and the central nervous system.

2 semester hours.	Lecture
Dr. F. T. Jung	9:00-10:30 A. M.
Tuition, $25.00	Laboratory
	1:00-4:30 P. M.

Applied Anatomy. A course of advanced study of muscle function.

2 semester hours.	Lecture
Dr. Verne T. Inman	8:00-9:00 A. M.
Tuition, $20.00.	Lecture
	10:30-11:30 A. M.

Use of Physical Therapy in Injury. A lecture course including the study of injury to the back, arm and shoulder, hand, leg and foot from an anatomical, physiological and pathological viewpoint, the surgical treatment and the application of physical therapy in these injuries.

2 semester hours.	
Dr. Harry E. Mock	5.00-6:00 P. M.
Dr. Paul B. Magnuson	7:00-8:00 P. M.
Dr. Sumner L. Koch	
Dr. Emil D. W. Hauser	
Dr. John S. Coulter	
Tuition, $20.00.	

Application for Admission.

All students must file an application blank for admission. State that you wish to make application for the course sponsored by the American Physiotherapy Association. Applications must be received before June 1, 1942. An advance payment of $5.00 is requried when the application is approved. This payment is not returnable but is credited on the tuition fee.

Registration.

Credit cannot be obtained for more than 4 semester hours during this period of three weeks. A registration fee of $5.00 will be required at the time of registration.

Registration will take place July 6, 1942.

Living Accommodations.

Tentative arrangements have been made for room and meals at Abbott Hall. All communications regarding this course and applications should be made to the Dean of the Northwestern University Medical School, 303 East Chicago Avenue, Chicago, Illinois.

Educational Exhibits

A prize of $10 will be offered for the best exhibit sent to the 1942 convention. For further information, write the Exhibits Chairman, Mrs. Margaret C. Winters, 950 East 59th Street, Chicago, Illinois.

Are You Interested in Mechanical Devices for Patients with Paralyzed Arms and Hands? If so, we know of an excellent film on this subject. For further information, write the Exhibits Committee.

Pennsylvania Academy of Physical Therapy

The Pennsylvania Academy of Physical Therapy held a meeting at the Philadelphia County Medical Society Building in Philadelphia, Penna., on February 19, 1942. "Principles of Electrotherapeutic Equipment" were discussed by David M. Speaker, B.A., B.S., Electrical Engineer, Research Laboratories of the Abington Memorial Hospital.

Index to Current Literature

Allergy

The Nature of Allergy: Its Pathology and Mechanisms of Symptom Production. MILTON B. COHEN, M. D. Northwest Med., Jan. 1942.

Short Wave Therapy in the Treatment of Sinusitis and Allergic Rhinitis. G. R. BRIGHTON, M. D., WILLIAM BENHAM SNOW, M. D., and HERBERT S. FRIEDMAN, M. D. J.A.M.A., Feb. 14, 1942.

Amputations

Amputations of the Upper Extremity. HENRY H. KESSLER, M. D. Med. World, Feb. 1942.

Anterior Poliomyelitis

Poliomyelitis: An Alimentary Infection. Minn. Med., Feb. 1942.

The Operative Treatment of the Lower Extremity in Infantile Paralysis. A. R. SHANDS, JR., M. D. Arch P. T., Feb. 1942.

The Clinical Significance of Certain Microscopic Changes in Muscles of Anterior Poliomyelitis. HERBERT E. HIPPS, M. D. J. Bone and J. Surg., Jan. 1942.

Apparatus

An Improved Ischial Seat Brace. WALTER I. GALLAND, M. D. J. Bone and J. Surg., Jan. 1942.

An Adjustable Volar-Flexion Splint. HAROLD H. COHEN, M. D. J. Bone and J. Surg., Jan. 1942.

Two Small Wire Splints for the Treatment by Traction of Fractures and Deformities of the Fingers and Metacarpal Bones. JOHN LYFORD III, M. D. J. Bone and J. Surg., Jan. 1942.

A Combined Epilation Needle and Forceps Handle. H. C. GOLDBERG, M. D. Arch. Derm. and Syphil., Dec. 1941.

Arthritis and Rheumatism

Rheumatic Heart Disease. B. J. CLAWSON. Trends, Nov. 1941.

The Treatment of Periarthritis of the Shoulder by Physical Medicine. WALTER M. SOLOMON, M. D. Brit. J. Phys. Med., Jan. 1942.

Tuberculosis of the Hip: A Review of Seventy-six Patients with Proved Tuberculous Arthritis of Seventy-Seven Hips Treated by Arthrodesis. CARL E. BADGLEY, M. D., and GEORGE HAMMOND, M. D. J. Bone and J. Surg., Jan. 1942.

Bone and Joint Diseases and Injuries

The Pelvifemoral Angle: Determination of Hip-Flexion Deformity. HENRY MILCH, M. D. J. Bone and J. Surg., Jan. 1942.

Calcification and Ossification. III: *The Role of Local Transfer of Bone Salt in the Calcification of the Fracture Callus.* MARSHALL R. URIST, M. D. J. Bone and J. Surg., Jan. 1942.

Cardiac Conditions

The Value of Physical Therapy in the Management of the Cardiac Patient. WILLIAM G. LEAMAN, JR., M. D. Arch. P. T., Jan. 1942.

Rheumatic Heart Disease. B. J. CLAWSON. Trends, Nov. 1941.

Education

Postgraduate Education in Industrial Health. Editorial, J.A.M.A., Feb. 21, 1942.

Electrotherapy

Electrotherapy in Flaccid Paralysis. PAUL LIEBESNY, M. D. Arch. P. T., Jan. 1942.

Muscle Reeducation in Therapy, Including Electrical Stimulation of Muscles and Nerves. WILLIAM BENHAM SNOW, M. D., and A. DAVID GUREWITSCH, M. D. Arch. P. T., Feb. 1942.

Electrical Aids in Diagnosis and Prognosis of Nerve Injuries. ARTHUR L. WATKINS, M. D. Arch. P. T., Feb. 1942.

Eye, Ear, Nose and Throat

Choice of Treatment of Cancer in Otolaryngology. T. C. GALLOWAY, M. D. Annals Otology, Rhinology and Laryngology, Dec. 1941.

Short Wave Therapy in the Treatment of Sinusitis and Allergic Rhinitis. G. R. BRIGHTON, M. D., WILLIAM BENHAM SNOW, M. D., and HERBERT S. FRIEDMAN, M. D. J.A.M.A., Feb. 14, 1942.

Fractures

Compound Fractures. HARRY C. BLAIR, M. D. Northwest Med., Jan. 1942.

Fractures of Ribs. PAUL H. HARMON, M. D., D. R. BAKER, M. D., and R. D. KORNEGAY, M. D. J.A.M.A., Jan. 3, 1942.

Hydrotherapy

Hydrotherapy in the Rehabilitation of Nerve Lesions. MATTHEW B. RAY, D.S.O., M. D. Brit. J. Phys. Med., Jan. 1942.

Hyperpyrexia

The Practical Application of Fever Therapy in Military Medicine During Active Service. KENNETH PHILLIPS, M. D. Brit. J. Phys. Med., Dec. 1941.

Injuries

How to Prevent and Treat Athletic Injuries. GEORGE W. HAUSER. Trends, Nov. 1941.

Discussion: *Football is Not Dangerous.* BERNARD W. BIERMAN. Trends, Nov. 1941.

Three Most Common Types of Football Injury. Trends, Nov. 1941.

Internal Derangement of the Knee in the Athlete. EDWARD T. EVANS. Trends, Nov. 1941.

Taping to Prevent Athletic Injuries: With Demonstration of Taping Technic. LLOYD STEIN. Trends, Nov. 1941.

Valgus Deformity of the Knee Resulting from Injury to the Lower Femoral Epiphysis. LEROY C. ABBOTT, M. D., and GERALD G. GILL, M. D. J. Bone and J. Surg., Jan. 1942.

Low Back Pain

Congenital Anomalies and Low Back Pain. EDWARD L. COMPERE, M. D. Med. World, Feb. 1942.

An Anatomical Explanation of Traumatic Low-Back Pain. EDWARD J. HABOUSH, M. D. J. Bone and J. Surg., Jan. 1942.

Miscellaneous

The Deposition of Calcium in the Hearts and Kidneys of Rats in Relation to Age, Source of Calcium, Exercise and Diet. LEROY L. BARNES, Ph. D., Amer. J. Pathol., Jan. 1942.

The Quality of Massage. J. Chart. Soc. M. & Med. Gym., Jan. 1942.

Myogeloses: The Significance of Pathologic Conditions of the Musculature in Disorders of Posture and Locomotion. HENRY H. JORDAN, M. D. Arch. P. T., Jan. 1942.

The Treatment of Pelvic Infection by Iontophoresis of a Choline Compound. ALEXANDER H. ROSENTHAL, M. D. Amer. J. Surg., Dec. 1941.

Static Microtrauma. ERNEST T. DUSCHAK, M. D. Arch P. T., Feb. 1942.

Administration of a Physical Therapy Department. C. O. MOLANDER, M. D. Arch. P. T., Feb. 1942.

Nervous and Mental Diseases and Injuries

Myalgia of the Head. HENRY L. WILLIAMS, M. D. and EARL C. ELKINS, M. D. Arch. P. T., Jan. 1942.

Muscle Reeducation in Therapy, Including Electrical Stimulation of Muscles and Nerves. WILLIAM BENHAM SNOW, M. D., and A. DAVID GUREWITSCH, M. D. Arch P. T., Feb. 1942.

The Various Forms of Shock Therapy in Mental Disorders and Their Practical Importance. LOTHAR B. KALINOWSKY, M. D. N. Y. State J. Med., Nov. 15, 1941.

Painful Arm and Shoulder, with Especial Reference to Problem of Scalenus Neurocirculatory Compression. R. G. SPURLING and E. G. GRANTHAM. Mo. State Med. Assn. J., Oct. 1941.

Electrical Aids in Diagnosis and Prognosis of Nerve Injuries. ARTHUR L. WATKINS, M. D. Arch. P. T., Feb. 1942.

Obstetrical Paralysis. ROBERT LEE PATTERSON, JR., M. D. Arch. P. T., Feb. 1942.

The Value of Physical Methods in the Treatment of Injuries of the Peripheral Nerves. W. ROWLEY BRISTOW, M. B. Brit. J. Phys. Med., Jan. 1942.

Hydrotherapy in the Rehabilitation of Nerve Lesions. MATTHEW B. RAY, D.S.O., M. D. Brit. J. Phys. Med., Jan. 1942.

The Surgical Approach to Hypertension. GEZA DE TAKATS, M. D., H. E. HEYER, M. D., and R. W. KEETON, M. D. J.A.M.A., Feb. 14, 1942.

Compression of Brachial Plexus. FREDERICK LEET REICHERT, M. D. J.A.M.A., Jan. 24, 1942.

Peripheral Vascular Diseases

Organic Occlusive Peripheral Vascular Disease. ROY J. POPKIN, M. D. Northwest Med., Jan. 1942.

Physical Fitness

The Contribution of Physical Education to Fitness. F. A. HELLEBRANDT. J. Health & Phys. Educ., Feb. 1942.

The Civilian Defense Physical Fitness Program. WILLIAM L. HUGHES. J. Health & Phys. Educ., Feb. 1942.

Recent Trends in Physical Examination Under Civil Service. VERNE K. HARVEY, M. D. J.A.M.A., Feb. 21, 1942.

Physical Characteristics of Exceptional Athletes and of Naval Personnel. W. C. WELHAM, M. D. and A. R. BEHNKE, JR., M. D. J.A.M.A., Feb. 14, 1942.

Physical Therapy

Fundamentals of Physical Therapy in General Practice. KENNETH PHILLIPS, M. D. Arch P. T., Jan. 1942.

An Evaluation of Physical Therapy. W. BARNETT OWEN, M. D., and K. ARMAND FISCHER, M. D. Crippled Child, Feb. 1942.

The Evolution of Physical Medicine in the United States. RICHARD KOVACS, M. D. Brit. J. Phys. Med., Dec. 1941.

Rehabilitation

The Rehabilitation of Injured Miners. JOHN H. C. COLSON. J. Chart. Soc. M. & M. Gym., Jan. 1942.

Wisconsin's Program for Its Handicapped Children. FRANK V. POWELL. J. Except. Children, Feb. 1942.

Short Wave Diathermy

Irritable Colon Treated with Short Wave Diathermy: Preliminary Report. WALTER J. ZEITER, M. D., and R. F. RENSHAW, M. D. Brit. J. Phys. Med., Dec. 1941.

Short Wave Therapy in the Treatment of Sinusitis and Allergic Rhinitis. G. R. BRIGHTON, M. D., WILLIAM BENHAM SNOW, M. D., and HERBERT S. FRIEDMAN, M. D. J.A.M.A., Feb. 14, 1942.

Speech

Emotional and Physical Responses of Birth Injury Cases to Speech Correction. ELLEN H. MOORE. J. Except. Children, Jan. 1942.

Surgery

Tenotomy of Tendon Achilles. GEORGE ANOPOL, M. D. Med. World, Feb. 1942.

Results of the Lowman Operation for Paralysis of the Abdominal Muscles. GEORGE A. WILLIAMSON, M. D., JOHN H. MORE, M. D., and W. COMPERE BASOM, M. D. Minn. Med., Feb. 1942.

The Operative Treatment of the Lower Extremity in Infantile Paralysis. A. R. SHANDS, JR., M. D. Arch. P. T., Feb. 1942.

Surgery of the Intrinsic Muscles of the Hand Other than Those Producing Opposition of the Thumb. STERLING BUNNELL, M. D. J. Bone and J. Surg., Jan. 1942.

The Use of Preserved Bone Graft in Orthopedic Surgery. ALBERTO INCLAN, M. D. J. Bone and J. Surg., Jan. 1942.

Tuberculosis

Treatment of Tuberculosis. ALAN DEFOREST SMITH, M. D. Crippled Child, Feb. 1942.

Resection of Elbow for Tuberculosis. DAVID M. BOSWORTH, M. D. Med. World, Feb. 1942.

Tuberculosis of the Hip. A Review of Seventy-Six Patients with Proved Tuberculous Arthritis of Seventy-Seven Hips Treated by Arthrodesis. CARL E. BADGLEY, M. D., and GEORGE HAMMOND, M. D. J. Bone and J. Surg., Jan. 1942.

Ultraviolet Radiation

The Knott Technic of Ultraviolet Blood Irradiation in Acute Pyogenic Infections. GEORGE MILEY, M. D. N. Y. State J. Med., Jan. 1, 1942.

Ultraviolet Irradiation of Autotransfused Blood in the Treatment of Puerperal Sepsis. E. W. REBBECK, M. D. Amer. J. Surg., Dec. 1941.

ABSTRACTS

John S. Coulter, M.D.

Thrombosis in Arteriosclerosis of the Extremities

E. D. Telford, B. Chir., F.R.C.S. Emeritus Professor Surgery, University of Manchester, and H. T. Simmons, M. D., Ch. M., F.R.C.S. Research Fellow, Manchester Royal Infirmary. In Brit. Med. J., No. 4216, October 25, 1941.

Beyond the use of sedatives for pain there is little that can usefully be done during the first few days after the acute onset. We could, however, draw attention to what has seemed to us a point of importance in the nursing of the case. It is customary in the treatment of deficient arterial circulation in the lower extremity to send the patient to bed and to keep the limb horizontal or even elevated; some form of heat or warm wrappings usually are employed. We believe this line of treatment to be wrong. The raised position encourages the veins to drain away too rapidly a blood supply which already is gravely limited by the arterial block; an increase in the ischemia results, and the starved extremity may be pushed over the brink of gangrene. The correct handling of such a limb is to keep it dependent and cool. It is remarkable how quickly patients with deficient arterial circulation learn to hang the limb over the edge of the bed in the open.

With the disappearance of pain the patient may be encouraged to get about, and the treatment should be directed to obtaining some degree of vasodilatation. Padutin or similar drugs and hot and cold contrast baths, with postural exercises, may be used with advantage. Treatment by intermittent venous occlusion is well worth a trial and has seemed to bring about some improvement in several of our patients. Massage, radiant heat and electric therapy should be avoided; they may be actually harmful.

The Influence of Temperature on Wounds

Barney Brooks, M. D., and George Duncan, M. D., Nashville, Tenn. In Annals of Surg., 114:6:1069, December 1941.

The use of local applications of heat or cold for the treatment of disease is as old as recorded medicine.

Reduction of the temperature of the tissues certainly exercises a marked effect on the exudation of fluids into tissues and on the disintegration of devitalized tissues, so that no matter which of the two most generally accepted theories of shock is accepted, it would appear that the results obtained in these experiments do not support the generally accepted use of the application of external heat for the prevention of treatment of surgical shock. In surgical shock the temperature of the cold, bloodless extremities would be more influenced, *en masse*, than extremities with an abundant circulation.

These experiments at least suggest that there is reasonable doubt of the wisdom of inhibiting an inflammatory reaction by cold application or of the universal application of heat to the extremities of a patient in surgical shock. After all, these conditions are natural responses, and efforts to reverse normal physiologic processes bring to mind the now universally discarded fever reducing drugs of the past.

Physical Therapy Equipment as it Applies to Safety in Hospitals

John E. Gorrell, M. D. In Hospitals, 16:1:26, January 1942.

If you conclude that physical therapy equipment must be made in the hospital, there are simple but important rules to follow:

1. *Design.* It must be based on sound medical knowledge, good engineering, and best safety practice. The unit should be flexible and have a great margin of safety.

2. *Construction.* It must be built exactly as specified in your written orders and sketches, or improved with your approval. Do the job right or not at all.

3. *Test and Approval.* It must be subject to some carefully controlled tests after the device has been constructed and before it is placed in use. Get a competent engineer to make a real search for hidden dangers. If you can afford to build your own apparatus you cannot afford to not get the advice of the Underwriters Laboratories. This is easily done. If possible, ship the apparatus to their Laboratories, or if this is impractical, ask their representative to inspect it, make recommendations, and when it is safe issue a certificate to that effect. Then, and only then, you will have something really worth while; and as safe as the best commercial product.

A department with safe and modern equipment is the ideal place to start maintenance for protection and efficiency. Remember that "accidents do not happen—they are caused." You do not want accidents, but if they do occur find out who and not what is responsible.

The first step in employee selection is to get a person who is fitted for the job. There is no better combination than a person with a sincere love for the work coupled with good training and experience. It is a man-sized job to find and select such a person—it is a much greater problem than buying the apparatus.

Rheumatism and Arthritis

Review of American and English Literature for 1940

(Eighth Rheumatism Review)

Philip S. Hench, M. D., F.A.C.P., Rochester, Minnesota, Walter Bauer, M. D., F.A.C.P., Boston, Edward Boland, M. D., Los Angeles, M. Henry Dawson, M. D., New York, Richard H. Freyberg, M. D., Ann Arbor, W. Paul Holbrook, M. D., F.A.C.P., Tucson, J. Albert Key, M. D., F.A.C.S., St. Louis, L. Maxwell Lockie, M. D., F.A.C.P., Buffalo, New York, and Currier McEwen, M. D., F.A.C.P., New York. In Annals of Int. Med., 15:6:1002, December 1941.

Rheumatoid Arthritis

Rest and Motion. "Rest is the hardest but the most important medicine to take." Systemic rest is almost a sine qua non for seriously ill arthritic patients. Preferably this means putting a patient to bed in a hospital. When rest in bed is impossible the patient should regulate his activities to permit as much rest as possible. But "body-rest in bed" must be combined with "joint-motion in bed" to prevent contractures by moving each joint through its full range of motion once or more daily.

A cheap heating lamp used 365 days a year is of far greater value than some elaborate form of physical therapy which the patient can afford only for a few days or weeks. "I am convinced from long experience that, when patients are properly instructed concerning home massage, much more good than harm will result even though the amateur masseuse cannot hope to approach the skill of the trained technician."

Indications for short and long wave diathermy were discussed. Diathermy provides the most effective source of deep local heat. Diathermy may aggravate acute arthritis or bursitis unless given in small doses. In the treatment of bursae and the more superficial joints Kovacs preferred long wave to short wave diathermy. Some who considered diathermy "useless" for rheumatoid arthritis preferred galvanism.

The newer technic of contrast baths, indications for paraffin baths, various forms of light therapy and hydrotherapy were described. Ultraviolet therapy is contraindicated in presence of fever. The distinct advantages of underwater therapy were stressed.

Treatment of Bursitis. For cases of "acute bursitis" or "acute calcareous tendinitis" most physicians recommended the injection of procaine hydrochloride into the affected tissues, aspiration of exudate or calcium containing material, and multiple needling of the bursa under local or general anesthesia.

For less acute cases or for those patients who will not permit needling and irrigation, rest in abduction, and physical therapy (diathermy) were advised. Wilson considered diathermy useful in some cases, useless in others. Solomon and Weeks regarded diathermy as contraindicated in acute cases; heat merely increases congestion and tension; cold applications for the first 48 hours were preferred. In chronic cases especially of contractures due to capsular adhesions, relief is often provided by conservative measures; physical therapy and "traction-suspension." For chronic cases in which motion is limited by "mature adhesions" manipulation under anesthesia was considered dangerous by some, valuable by others who described their technic and supplemented manipulation by traction in abduction and the use of an exerciser. For ruptured tendons surgical repair is required; a new technic was described.

Treatment of Primary Fibrositis. This remains as outlined in recent Reviews. Recommended were removal of infected foci, correction of postural defects, avoidance of mental and physical exhaustion, and various forms of physical therapy: "rest, warmth, purgation, sweating and massage." Massage over tender spots "to break up the fibrous nodules" was again recommended as the most important single remedy. In cases of old fibrositis of back muscles manipulation was recommended. To prevent exacerbations of fibrositis patients should try to avoid respiratory infections, chilling, dampness and fatigue.

One of the outstanding lessons of the first world war concerned the great importance which physical therapy played in the rehabilitation of war wounds. The belated recognition of this fact resulted in needless suffering and disability. Early physical treatment could have reduced greatly the pension costs of disabled soldiers. The "reservicing" of casualties requires trained professional and technical personnel and adequate equipment. The organization of physical therapy for war time needs should be in the hands of those who have made it a special study. It was recommended that a Director of Physical Therapy be appointed to render service to the Ministry of Health. The director should head a central organization to be responsible for (1) the creation of a central register of those qualified in physical therapy, (2) the enlistment of qualified specialists for military and special civil duties, (3) the correlation of their work with those in all other branches of service, (4) an adequate supply of technical personnel to manufacture and keep in repair sufficient apparatus, (5) the control and distribution of all available apparatus, (6) the formation of large physical therapy units in certain base hospitals and smaller units to be made temporarily available to other base or field hospitals as necessary, (7) the continued training of personnel so that efficient surgical and medical teams may be kept available for remedial work. The special value of occupational therapy in military hospitals also was stressed.

As a result of such advice facilities for physical medicine were organized (May 1939) by the Ministry of Health under the Emergency Hospital Scheme with Sir Robert Woods as consultant adviser in physical medicine to the Ministry of Health. Eleven more or less autonomous administrative regions were established in England and Wales, the London region being divided into 10 sectors. In each sector is a specialist in physical medicine. These specialists constitute the "Medical Personnel." The "Auxiliary

Personnel" comprises 6,000 members of the Chartered Society of Massage and Medical Gymnastics who have volunteered for war service and have been classified as to experience, seniority, etc. The "Equipment Personnel" is responsible for the production and maintenance of needed apparatus of which two simple agents were of preeminent value: (1) various methods for producing heat, and (2) electrical currents to stimulate muscle contractions. This personnel is also responsible for space facilities. Under this scheme physical therapy is available for rheumatic patients at all Emergency Medical Hospitals with more than 300 beds.

For the application of physical therapy to rheumatic soldiers in mobile hospitals, evacuation centers or base hospitals without adequate electricity simple non-electrical methods are required. Several simple methods were improvised by Copeman.

They included a steam bath made up of two towel rails on three sides of an ordinary canvas chair, the whole being covered with layers of sacking under which steam was led through a rubber tube attached to a large tin or kettle boiling on a primus stove; a radiant heat lamp made out of two petrol tins with a sheet of metal behind to act as a reflector, the source of heat being a plate of cast iron or a bundle of gas "elements" placed over a primus stove and allowed to glow to a dull red.

American Preparedness. At the request of the Surgeon General's office, U. S. Army, the American Rheumatism Association has canvassed its members as to their willingness and qualifications for special military service. Groups of senior and junior medical and orthopedic consultants on rheumatic diseases have been established provisionally and data thereon have been transmitted to the Surgeons General of the Army, Navy and Public Health Department. A brief synopsis on the diagnosis and treatment of the common rheumatic diseases has been prepared to be disseminated from the Surgeon General's Office as a circular letter to all medical officers in the Army. American physical therapy consultants and technicians are likewise being mobilized and a primer on the simpler methods of applying physical therapy is in preparation. Coulter and others have discussed the place of physical therapy in the American military service. Physical standards set up for the selection of soldiers under selective service include data on the relative disablement caused by residual or active rheumatic diseases.

The Fibrositic Headache

Drury Pennington, M.B., B. Ch. (Camb.). In Brit. J. Phys. Med., 4:11:199, November 1941.

Of the many causes which contribute to aches and pains in the head it is surely true to say that fibrositis in the muscles of the neck is rarely recognized as a prime causative factor. It may, therefore, be worthwhile to direct attention to what in my experience is one of the more common types of headache. The latter is characterized by the following feature:

1. A chronic frontal headache, most marked when the patient wakes in the morning but tending to wear off as he moves about;
2. A headache associated with intermittent attacks of giddiness; or
3. Headaches accompanied by numbness and tingling in one or both hands, felt mostly when the patient is in bed and after an hour or more of sleep.

Thus to confirm diagnosis and to test a pathological postulate, my recommendations are as follows: Seat a patient troubled with a headache on a straight-backed chair or stool, raise his head vertically with one hand under the chin and the other under the occiput. It is usual to find that the patient volunteers some statement such as, "That clears my head while your are lifting it." Now press the head down firmly with the chin pointing to the patient's sternum. The headache thereby is intensified. This also happens, although less frequently, if the head is forcibly extended backwards so that compression is exerted on the cervical vertebrae.

Treatment fortunately resolves itself into the use of the appropriate measures peculiar to physical therapy. These measures, taken in the order of rapidity of cure, are:

1. Manipulation, in practiced hands;
2. Massage;
3. Ionization with either histamine in those who are tolerant of the substance, or salicylates.

As a rule, manipulation for some six times at three-day intervals, relieves the worst symptoms, but it is well to complete every case with massage to remove all trace of nodulation.

Ionization, to begin with, is indicated in thick-set muscular necks, or short, fat necks, found mostly in women. In such cases a terminal course of manipulation effects the final relief.

A Treatment for Chronic Psoriasis

Allan Bigham, M. D., Honorary Dermatologist, Bradford Royal Infirmary. In Brit. Med. J., No. 4219, November 15, 1941.

My method has been as follows: The patient is told to rub 2 per cent crude coal-tar ointment in soft paraffin into all lesions each night. In the morning, with the ointment still on, the patient goes to the ultraviolet radiation department, where the ointment is removed by means of olive oil, a thin film of which is left on; then the ultraviolet irradiation is carried out. This treatment is given every day. At the same time the patient takes 1,000 units of vitamin B_1 by mouth daily. In some cases the ointment is so removed by movement in bed at night that it has to be reapplied in the morning before going to the radiation department. In other cases in which there are particularly thickened lesions I add 20 to 30 grains of salicylic acid to the tar ointment and advise the patient to scrub off the scales with a stiff brush or by the use of pumice stone. The ointment is reapplied after this exfoliating treatment, and then the radiation treatment is carried out as above. In certain cases I have used, in addition to the above measures, 300,000 units of vitamin D daily, but I have found that patients who have not had this have done just as well as those who have.

Frostbite and Kindred Ills

Raymond Greene, D. M. Oxfd., Physician, E.M.S.; Medical Officer to the Kamet Expedition 1931 and Everest Expedition 1933. In Lancet, CCXLI: 6171:689, December 6, 1941.

If, despite all care or because of its lack, cases occur, treatment depends on the stage at which it is undertaken, not on the clinical type of frostbite. The premonitory symptom may be a white patch on the face, for which men in very cold conditions should be trained to watch. This usually can be cured by the immediate application for a few seconds of a warm ungloved hand. If feet or hands become numb no time must be lost. Boots and socks or gloves must be removed instantly and the limb warmed by placing it inside another man's clothes. Gentle massage may be used, but it should not be continued for more than a few minutes. Rubbing the affected parts, with or without snow, is extremely dangerous. Either the tissues are dead, in which case they are beyond care or they are still alive. If they are still alive, the application of the most gentle warmth, never greater than that of the human body, will quickly restore the circulation; friction can only harm delicate and perhaps brittle tissues, and by increasing exudation increase damage. If these measures fail to restore warmth, the affected part should be thoroughly but gently cleaned, painted with an active antiseptic such as proflavine, wrapped in sterile dressings and in many layers of wool, and given complete rest. A man with only slight frostbitten feet is a stretcher case. A frostbitten hand must be carried in a sling. Antitetanus serum should be given, for tetanus after frostbite is common and very fulminant (Andrewes 1923). The patient should be given hot food and drinks and extra clothes and removed as quickly as possible to a place of comparative warmth and security. If the frostbite has occurred at a height above sea-level, whether in an aeroplane or on a mountain, pure oxygen should be given either with the B.L.B. mask or with the simpler face-piece of the author's design (Greene 1934b) until sea-level is reached. Thereafter, a policy of masterly inactivity should be pursued unless sepsis develops in which event it should be treated like sepsis from any other cause. Excessive warmth should be avoided throughout, hot cradles being specifically forbidden. Between the part irretrievably doomed to gangrene (if such there be) and the part never endangered there is probably an area striving for life in a state of anoxia. Heat to this part will increase its metabolism and its oxygen requirements, and will encourage the growth of bacteria. Frostbitten parts must be kept cool.

A number of active treatments have been suggested but are still subjudice. Short-wave treatment has been advocated by Burkmann (1934) but it is difficult to see what good could come of it. Passive vascular exercise is popular in the United States but has been little used here and nowhere under properly controlled conditions. It appears at first sight to be dangerous, for should the arterial supply to the limb be increased the capillary pressure would be further raised and transudation increased. On the other hand, if pressure-changes were used sufficient only to effect the venous side of the circulation the capillary pressure would be lowered and good might come. I hope to be able to provide some experimental evidence on this point later.

Observations on Some Normal and Injurious Effects of Cold Upon the Skin and Underlying Tissues

III. *Frostbite*

Sir Thomas Lewis, M. D., F.R.C.P., F.R.S. Physician to University College Hospital. In Brit. Med. J., No. 4224, December 20, 1941.

Our knowledge of frostbite and the manner in which the skin reacts to it suggests certain measures in its treatment, which will be dealt with briefly.

When the patient is seen at a stage at which the tissues are frozen the first step will be to induce thawing. There are two reasons why this should not not be done too rapidly. First thawing will be followed by intense swelling of the tissue, and this in itself is probably injurious. Secondly, the more rapid the warming the greater will be the pain, and following thawing it may be very severe. The long-established custom of rubbing the frozen part with snow will ensure slow thawing, and its reputed effectiveness probably depends on this fact. But friction is not to be recommended in itself: thawing will not occur unless friction is brisk, and such friction will tend to damage the skin and to increase the reaction. It would seem preferable, when it is practicable, to apply warmth of reasonable amount. The object should be to restore the blood flow and warmth gradually and thus restrain vascular and accompanying reactions.

When this has been effected the limb may be protected by wrapping it lightly with cotton-wool or lint, covering it with a cradle, and maintaining around it a reasonably cool temperature. Further treatment will be demanded by blisters and by necrosis with ulceration. From this standpoint it should be recognized that between the lesions following freezing and those following heat there is no fundamental distinction. The reactions that follow are not properly regarded as reactions to frost or to heat, but to tissue injury. The heating and the freezing are transient, and the reactions we see are the reactions to what heat and frost leave behind them. In both instances the reaction is a response to substances released largely from living cells and in part from killed cells. It follows from what has been said that the rational treatment of the lesions of frost-bite and scald have much in common. The appropriate routine treatment of one or other state must of course be governed ultimately by one consideration only—namely, by its proved effectiveness. But in considering new means of treatment, theoretical considerations can be a guide. A guide to the treatment of lesions following frostbite which I would strongly recommend is that they should be dealt with in the same way as are similar lesions resulting from heat, in respect of the treatment of which we possess much recent experience.

Short Wave Therapy in the Treatment of Sinusitis and Allergic Rhinitis

George R. Brighton, M. D., William Benham Snow, M. D. and Herbert S. Friedman, M. D., New York. In J.A.M.A., 118:7:507, Feb. 14, 1942.

The authors' survey would indicate that, at best, short wave therapy, if combined with other routine measures in common use by the otolaryngologist, is to be recommended only for the alleviation of pain and diminution of discharge in chronic and subacute sinusitis. It has no therapeutic value in allergic rhinitis and it does not appear to expedite the recovery of acute sinus infections, in which the prognosis with adequate conservative therapy has been found to be favorable.

The preference expressed by many continental observers for the shorter wavelengths (6 to 12 meters) in intranasal therapy seems to be based on acceptable clinical evidence.

To date the accepted version of the effects of short wave therapy is that any favorable result is brought about by the heat produced in the tissue treated and by the accompanying physiologic response to such heat.

The authors selected an apparatus, A.M.A. Council accepted, of 12 meters with sufficient output to permit the use of arms with spacing.

In all cases a disk 7 inches in diameter was placed over and parallel to the nose and forehead of the patient, the electrode centered over the bridge of the nose. The other electrode was placed anteriorly over the sternal region, the edges of the disks approximately 11 inches apart.

Treatments in acute cases were given daily and preceded immediately by the usual nasal procedures to assure free drainage.

Twenty-five typical cases of allergic rhinitis as proved by history, cutaneous tests and clinical findings were treated by short wave therapy.

Another group of 25 patients suffering acute purulent infections of the paranasal sinuses were treated by short wave therapy.

One hundred and ten patients suffering from chronic sinus diseases were treated by short wave diathermy three times a week for six weeks.

Temperature Sensation: The Spatial Summation of Heat

C. M. Herget and J. D. Hardy (From Russell Sage Institute of Pathology, in affiliation with New York Hospital and Dept. of Medicine, Cornell University Medical School, New York City.) In Amer. J. Physiol., 135:2:426, January 1, 1942.

It has long been recognized that heat sense differs in its qualities from warmth, but the nature of the physiological process producing the sensation of heat has not been at all clear. The attractive theory of Alrutz, that heat results from a simultaneous stimulation of warmth and cold receptors, found support in the work of Dallenbach and his collaborators, Cutolo, Altson and others. The composite picture presented by these workers was that not only could heat be elicited by simultaneous stimulation of warmth and cold, but also the areas to which these two stimuli were presented could be separated by as much as 10 to 15 cm. and still give a successful synthesis of heat.

Arrayed against acceptance of the Alrutz theory is the work of Heiser, Jenkins and others.

Summary

1. The threshold for heat as a function of area has been measured for two trained observers using radiation technic. The thresholds for both observers are the same.

2. Heat shows spatial summation, but to a lesser degree than does either warmth or cold.

3. Heat sensation is mediated by its own receptor type and is not a "synthetic sensation" due to warmth and cold.

Observations on Some Normal and Injurious Effects of Cold Upon the Skin and Underlying Tissues

1. *Reaction to Cold, and Injury of Normal Skin.* Sir Thomas Lewis, M. D., F.R.C.P., F.R.S. Physician to University College Hospital. In Brit. Med. J., No. 4222, December 6, 1941.

Effect on Blood Flow—When the body surface is exposed to cold the vessels of the skin normally contract, blood flow is reduced and heat loss from the skin is diminished. This vasoconstriction is a complex response; indeed, it comprises three separate reactions. First, there is a direct and persistent response of the superficial vessels to cold; they contract locally. Secondly, cold when applied to any part of the skin causes an immediate general vasoconstriction by reflex action through the central nervous system. This reflex, however, is only transient. It is succeeded and replaced by the third response. Cold venous blood returning from the cooled skin joins and lowers the temperature of the blood in the general circulation. This blood travels to, and acts upon, a central nervous mechanism, which is very sensitive to cold and responds by calling forth a general vasoconstriction, which is persistent. The second reaction is easily displayed; for if a limb is cooled while the circulation to it is cut off there is an immediate and transient general vasoconstriction, but the third reaction takes place only when the circulation to the cooled limb is restored.

It is important fully to realize that cold affects the normal skin in two distinct ways. It may damage the skin by direct action or by causing it to freeze. These two effects have often been confused; both have often been described under the term "frostbite". To avoid such confusion I shall limit that term strictly to effects which follow freezing of the skin and shall defer consideration of this subject until later. Here I propose first to discuss experimental evidence that normal skin can be injured by reduction of its temperature and without the intervention of a mechanical injury to the cells such as inevitably happens when ice crystals form in the skin. The evidence in question is derived from a number of different sources.

Operative Treatment of Cerebral Palsy of Spastic Type

William T. Green, M. D., and Leo J. McDermott, M. D., Boston. In J.A.M.A., 118:6:434, Feb. 7, 1942.

In surgical procedures directed toward chronic disease impressions of results often are misleading. It is necessary to pause at intervals and do end result determinations on groups of cases to make decisions as to the efficiency of various procedures.

Operations, important as they are, should be considered as an adjunct to the general plan of therapy. By the nature of the process which interferes with the normal motor pathways, the patient is forced to depend on accessory tracts and to adjust his motor mechanism to an awkward type of innervation. Training of this mechanism is the primary treatment, whether directed or undirected. Surgical procedures, by reducing deformity, establishing better balance of muscle power, decreasing the spasticity of muscles and simplifying the problem of control, often are an indispensable part of the process of rehabilitation. In many cases, however, surgical procedures are not indicated either by the nature of the process or by the other delimiting factors.

Certain basic criteria must be established before decisions are made regarding an operation, all dependent on a thorough evaluation of the patient. The type of paralysis and the degree of motor inadequacy must be classified as accurately as possible. Occasionally this may be difficult, as in the differentiation between true athetosis and certain instances of spastic paralysis with definite accessory motor overactivity. Ordinarily observation for a short period enables the differentiation to be made.

It should be determined whether the patient has sufficient sense of balance to allow the intended result.

The mental status of the patient is an important consideration in deciding whether an operation should be done and what procedure should be performed. Operations on the upper extremities are rarely indicated on patients who have gross mental deficiency, nor are finer adjustments in the motor mechanism of the lower extremities to be attempted on such a patient. However, operations should be performed on patients who cannot walk if it is felt that they may be made to walk either alone or assisted, even in the presence of well defined feeblemindedness. The ability to walk facilitates their care, even if they are totally dependent in other ways.

For patients of low mental status definitive procedures in which the factor of muscle training is less important should be chosen. Prolonged expensive training and hospitalization are not indicated.

A detailed examination of the muscles should be made. Not only must the spastic muscles be recognized and charted but, as emphasized by Phelps, the power of the other muscles must be evaluated and their degree of control noted.

The importance of evaluating the power of nonspastic muscles is emphasized by the fact that, as pointed out by Phelps, certain antagonistic muscles may show great weakness and, for practical purposes, even complete flaccid paralysis. This is particularly true in the muscles controlling the distal ends of the extremities. A flail paralysis may arise from a cerebral lesion, as pointed out by Fulton. On the other hand, long continued deformity may of itself cause the stretched muscles to lose power, which power will return when the deformity is corrected. If there is actually a flaccid paralysis in the antagonistic muscles, merely relieving the spasticity will not solve the problem.

The age of the patient is a delimiting factor. A certain type of operation may be done as a temporary measure at a younger age to facilitate function, although it is anticipated that it will be followed by another when the patient is older.

In considering the operative approach in an individual case, one should remember that the correction of one deformity reduces the problem of the patient in his total motor control.

These authors made a study of the results of 421 orthopedic operations on 160 patients with spastic paralysis which have been done during the past fifteen years. In 88 per cent an end result classification has been made. "Spasticity," independent of its origin, has been the criterion by which cases were included in the group.

The patients operated on in this series were delimited by the attitude that:

(a) Surgical procedures are an adjunct in the general plan of therapy for spastic paralysis.

(b) Orthopedic operations on patients with cerebral palsy of the extrapyramidal type are not often helpful.

(c) Operations are indicated in only a certain proportion of spastic paralysis, depending on the nature of the deformity and the general status of the patient.

Two hundred and twenty-eight of the operations were done for deformities of the feet. Lengthening of the heel cords, arthrodesis and neurectomy affecting the gastrocnemius were done in that order of frequency. Arthrodesis gave the best results, although comparisons are not valid. Lengthening of the heel cord is a good procedure provided certain principles are followed. Tendon transplantation is helpful in deformities of the foot.

Lengthening of the hamstring tendons was the most common operation at the knee. The results were better in those instances in which it was accompanied by lengthening of the upper end of the gastrocnemius.

The results from obturator neurectomy with adductor myotomy were disappointing, although all but 12 of the 66 resulted in improvement. Division of the branch of the median nerve to the pronator teres was helpful in correcting pronation deformity. Transplant of the flexor carpi ulnaris to the extensor carpi radialis longus was an excellent procedure for flexion deformity of the wrist as well as pronation deformity. It has been found to be more useful than neurectomy of the pronator teres.

The operative results in those patients with quadriplegia were not as good as in the other groups. All patients who could not walk after being operated on were quadriplegic.

Certain general comments may be made regarding those operations in which the result was "poor":

(a) The majority of the "poor" results were in those who were feebleminded or were in "motor status 1 or 2." In many the possibility of a "poor" result was considered prior to operation, but it was felt that an attempt should be made to give improvement. Certainly any error should be made in this direction rather than the other.

(b) The choice of procedure could be criticized in certain instances. Inattention to weakness in antagonistic muscles was a common mistake.

(c) Inadequate postoperative care and training were large factors in the "poor" group, in which the result should have been better. In this series, too brief immobilization in the corrected position was interpreted as the most frequent error in the postoperative regimen. The authors believe that intermittent support in the ideal position is desirable until the correction is stabilized, whether it requires months or years. The use of corrective casts at night should be a fundamental part of the routine.

The physical therapy during this period should emphasize, in addition to muscle training of the type usually prescribed in cerebal palsy, exercises to those specific muscles which oppose the deformity. Braces should be used if they are indicated, either as a temporary feature in establishing function or as a permanent measure if necessary.

Fat Necrosis From Exposure to Cold

H. Haxthausen. (From Dept. Dermatology and Venereology, Rigshospital, Copenhagen.) In Clinical J., LXXI:1:26, January 1942.

Since Feb. 1937, I have observed 5 cases of a peculiar morbid condition—hard infiltrations in the subcutaneous adipose tissue of the face, particularly in little children, produced by exposure to severe cold.

Changes in the subcutaneous fatty tissues resulting from cold are not unknown. As mentioned in chilblains—that is, in protracted exposure to moderate cold—hypertrophy of the subcutaneous fatty tissue in the lower part of the leg occurs. Microscopic examination often shows considerable cellular infiltrations, chiefly with round cells and plasma cells along the blood vessels in the adipose tissue, but never areas of true necrosis. P. Koefoed (1906) described a curious affection developing after application of an ice-bag to the abdomen. "The thick subcutaneous fatty tissue was infiltrated so markedly as to feel hard as wood. One had the impression of being faced by a phlegmon; but the temperature was normal, and an incision revealed no pus, merely a peculiar discoloration of the adipose tissue. The affection subsided spontaneously in a few weeks." There can hardly be any doubt that this was a similar affection to the one I describe.

Chronic Bronchitis in the Elderly

Frank A. Roper, M. D., M.R.C.P. Senior Physician, Royal Devon and Exeter Hospital. In Practitioner, CXLVIII:883:18, January 1942.

Considerations of space preclude exhaustive discussion of the many aspects of essential treatment in different cases, other than climatic. In most cases circumstances, both family and economic, compel compromise, not only in regard to climate but in the daily mode of life. Plenty of fresh air and some exercise are main needs, subject to weather and the strength and powers of resistance possessed by the patient. Diet is of importance and should be light, and any unnecessary alcohol should be discouraged.

Vaccines are exceedingly disappointing in chronic bronchitis.

Sulphonamides.—Modern chemotherapy also has but little useful application here.

Expectorants are useful in all cases in which it is necessary to aid the expulsion of excessive bronchial exudate.

Physical Treatment.—Although physical treatment cannot be carried out so effectively in the elderly, in fact cannot be borne at all by many, its importance for the younger type of patient should not be overlooked.

Postural drainage for the chronic bronchitic with bronchiectasis can be carried out quite simply by teaching the patient to lean out of bed on waking, with hands on a stool or on the floor, so that the expulsive effects of the morning cough are aided by gravity, and the accumulation of bronchial exudate is the more easily got rid of. In other cases it is preferable that a suitably inclined plane be constructed of wood, best with a bend at its middle making a double inclined plane, which can be covered with a mattress on which the patient can lie prone for a time. A suitable angle is about 25 degrees with the horizontal.

Breathing exercises also may be of great value. In generalized chronic bronchitis the pulmonary embarrassment is chiefly at the bases. The loss of range of expansion from many causes within and without the thorax, including the general enfeeblement of the patient, bring it about that basal bronchioles may never properly get rid of their contents, and alveoli in their hundreds of thousands become permanently closed. Regular daily breathing exercises, inspiratory and expiratory, such as those devised by Cortlandt Macmahon, directed to education of the expansive power of the lower thorax and diaphragm, carried out in a recumbent posture and aided by a trained operator, act by reclaiming the unused basal areas, enabling both the expulsion of residual exudate and consequently a material increase of total oxygenation.

No attempt is made here to discuss the appropriate and necessary treatment of any concomitant renal or cardiac disease. It must, however, be emphasized that the cardiac factor especially is of essential importance to the outlook in every case of chronic bronchitis.

Calcific Deposits in the Supraspinatus Tendon

Stanley J. Makowski, M. D., Glen Cove, N. Y. In Medical Times, Jan. 1942.

Painful shoulder is a disability frequently encountered. As the diagnosis is often apparently obscure, treatment sometimes is unsatisfactory.

Omitting gross injuries, such as fractures and dislocations, the three important lesions causing stiff and painful shoulders may be classified as follows:

1. Tears of the supraspinatus tendon.
2. Calcareous deposits in the tendon.
3. So-called periarthritis.

The pathology of this lesion consists first of tendinitis, then necrosis of some of the fibers of the tendon followed by deposition of calcium.

Mumford, along with other authors, firmly believes that diathermy is the treatment of choice. He states that all cases, treated by him in this manner, became well and the deposit either entirely disappeared or was considerably reduced in size. The average number of treatments required was twenty-one, given daily for the first two weeks, and then twice a week. Relief from pain was obtained in from three to ten days and complete restoration of function without pain resulted.

There is another form of treatment, frequently employed, which is worthy of mention. That is, aspiration or irrigation of the bursa with saline solution.

Finally I would like to mention the treatment subscribed to by Dick *et al.*, of Chicago. This is relatively a new form of treatment and I do not know of anyone else who has had much experience with it. The authors claim very good results under this medical management, which consists of (1) ammonium chloride by mouth, (2) rest of the diseased part, (3) physical therapy and (4) elimination of foci of infection. Of this management they say that there is a rapid disappearance of pain in the acute stage, and, when the deposit is not too dense, the ammonium chloride appears to cause an absorption of the calcified material. It is given in doses of one gram or more four times a day after meals. The purpose of the ammonium chloride is to produce mild acidosis, which tends to absorb deposits.

Rest of the diseased part is important. Patients should be instructed to refrain, as far as possible, from performing those movements of the shoulder which their own personal experience has shown to cause pain.

Physical therapy is helpful, the best form of which is diathermy.

Careful search for foci of infection should be made and proper treatment given.

Treatment of Some Affections of the Extremities

M. E. Ormsby, M.R.C.S., L.R.C.P. In Brit. J. Phys. Med., 4:10:140, October 1941.

Patients with a history of chilblains react best to very early treatment, e.g., on the first onset of cold weather or beginning of work which will expose them to damp or cold. Local ultraviolet radiation from carbon arc or mercury vapour lamp is the prescription of choice. The exposures should be to every aspect of the skin that a closely-fitting glove or stocking foot would cover. I consider this a most important and frequently neglected point. The dose should be such as gives a moderate erythema of arm or leg, and the patient should come every other day for the first two weeks, then twice or three times a week. Such action, with appropriate home treatment, keeps the patient free from symptoms and able to work. Alternative treatments are sinusoidal hand and foot baths, paraffin wax applied locally to hands and feet, wrist and ankle, faradic foot baths, massage with stimulating ointment, and exercises.

Acrocyanosis is usually more severe in cold weather, but local ultraviolet radiation and home treatment improve matters. The condition, however, does not clear up quickly, and much patience is required. Alternative treatment consists of medical electricity or wax.

Erythralgia is so painful that anything which will give relief is worth the trouble. Excessive heat and stimulating doses of ultraviolet radiation are out of place and may increase suffering, but mild sedative ultraviolet radiation often is helpful.

Raynaud's Disease in all its stages is particularly amenable to local ultraviolet radiation. Spasm is less, pain less severe, and the nutrition of the skin improves. When gangrene has occurred, ultraviolet radiation treatment locally and warm cod liver oil dressings give good results.

Effects of Interrupting and Restoring the Circulation to the Lower Extremities

D. Dauber, M. Landowne, L. N. Katz, and H. Weinberg (From Cardiovascular Dept. of Michael Reese Hospital, Chicago). In J. Clinical Invest., 21:1:47, January 1942.

1. The phenomena associated with the application and release of constricting tourniquets were observed.

2. Cardiac acceleration followed release of occluding cuffs about the lower extremities in normal subjects. This was absent or reduced in patients with thrombo-angiitis obliterans.

3. A fall in the blood pressure in the brachial artery preceded the cardiac acceleration.

4. The fall in blood pressure was caused by the opening of a temporary low resistance pathway for blood through the dilated vessels resulting from the previous occlusion of the limbs.

5. Evidence is cited to prove that the primary mechanism including the cardiac acceleration is a reflex response to the drop in pressure in the central arteries (Marey's Law).

6. The evidence presented also indicates that the cardiac acceleration is not caused by a metabolite accumulating in the constricted extremities; that it is not satisfied by the assumption that the reflex arises from the occluded vessel or from the tissue of the extremity.

The Treatment of Pelvic Infection by Iontophoresis of a Choline Compound

Alexander H. Rosenthal, M. D., Instructor in Obstetrics and Gynecology, Long Island College of Medicine, Brooklyn, N. Y. In Amer. J Surg., LIV: 3:639, December 1941.

The technic is quite simple and may be used as an office procedure for patients with pelvic inflammatory disease. The following equipment is necessary.

1. An apparatus capable of delivering a direct current of 15 to 20 milliamperes.
2. A vaginal electrode consisting of a metal rod surrounded by insulating material and terminating at one end in a small mobile crosspiece of metal.
3. Twenty cc. of ½ or 1 per cent mecholyl chloride (acetyl-beta-methyl-choline chloride) and a quantity of gauze sufficient to be soaked to about saturation.
4. A bivalve vaginal speculum and uterine dressing forceps.

The procedure is as follows: Before beginning treatment the abdominal pad is placed in warm tap water. Occasionally, difficulty in raising the milliamperage is due to insufficient soaking of the pad. With the patient in the lithotomy position, the speculum is introduced, the cervix exposed and all secretion is wiped away so that the drug may come into intimate contact with the vaginal mucosa. The gauze soaked with the solution of the drug is placed around the vaginal end of the electrode and introduced into the vault of the vagina. The small crosspiece of the electrode should be at right angles to the main bar and preferably in the posterior vaginal fornix. The gauze covered electrode is then held firmly against the fornices and the speculum withdrawn. The vaginal electrode is always attached to the positive pole and the current is increased very slowly to 15 to 20 milliamperes. The patient generally experiences a slight local sensation of shock if the current is increased too quickly. The abdominal pad is held firmly against the skin by a binder or sand bags. A sensation of pricking, burning or sticking due to failure of the pad to make sufficient contact may be eliminated by having the patient make pressure with her hands over the pad. Treatment lasts about twenty minutes, and at its conclusion the current should be decreased gradually otherwise the patient may experience a slight local shocking.

Pelvic iontophoresis of a choline compound was given to fifty-eight hospitalized patients with severe pelvic infection and thirty-nine patients with myomas of the uterus associated with pelvic inflammatory disease, degeneration of myomas, or both. As a result of frequent operation in the latter group, material for pathologic study was available in the great majority of cases, thus affording an excellent opportunity for determining the type of pathological condition treated and the effects produced.

Hydrotherapy in the Rehabilitation of Nerve Lesions

Matthew B. Ray, D.S.O., M. D., M.R.C.P. In Brit. J. Phys. Med., 5:1:5, January 1942.

The value of hydrotherapy in cases of psychasthenia, mental excitement, anxiety neurosis and similar conditions is becoming more and more recognized, so much so that most mental hospitals dealing with acute cases are now equipped with the necessary installation. In this connection the *subthermal* or warm bath at "neutral" temperature is employed.

Most textbooks describe three stages in poliomyelitis: (1) preparalytic; (2) paralytic, and (3) convalescent (divided by some observers into subacute, early and late chronic stages).

For all practical purposes only the first two stages require to be differentiated. It is usually taught that complete physiological rest for the weak and paralyzed muscles must be secured for periods ranging from a few weeks to a few months after the onset.

It is not difficult to see that the absence of a suitable pool is a serious handicap to recovery. Splinting should be continued during pool treatment otherwise the weight of a part may drag on the affected muscles. Buoyancy naturally relieves much of the weight, but splinting reduces the tendency of a part to sink to a level lower than normal.

Spastic Paralysis

Included under this heading is a group of conditions the opposite of infantile paralysis or of poliomyelitis which is mainly flaccid in type. Among the types recognized are: (1) myasthenic; (2) athetoid; (3) spastic and rigid: (4) ataxic with defective balance. The spastic condition, with over-active flexor-adductor-pronator responses is very much improved by pool treatment, because the warm water brings about muscular relaxation. The sedative effect gives an increased chance for the development of the muscles which stabilize the trunk, neck and respiratory movements. The ataxic type can also benefit from pool treatment, since education of muscle, tendon and joint reflex is needed.

What has been said above regarding the ease with which movement can be carried out under water in idiopathic lesions applies with equal force to the treatment of traumatic cases. When a nerve has been injured or its work otherwise interfered with, massage, passive movement and various electrical treatments all play their part, up to a point, in restoring function to the affected muscles. None of these methods of treatment can take the place of a nerve stimulus arriving at the muscle through its normal channels. Owing to lack of use, the muscles frequently are wasted and diminished in power. When a patient finds movements which, in ordinary circumstances, are difficult or impossible becoming comparatively easy in water, he is encouraged and strengthened in his resolve to persevere in his efforts.

The Physiology of Work

A C. Ivy, Ph.D., M. D., Chicago. In J.A.M.A., 118:8:569, February 21, 1942.

It is known that when a person performs work in the ordinary sense a constant ratio between energy expenditure and output is not found, even when "muscular work" is performed. This is because the efficiency of the muscular movements varies. The mechanical concept of work is adequate when the mechanical aspects or work is considered. It is also adequate when one desires to calculate approximately the calories of food required to maintain the body when a known amount of muscular work is to be performed. The mechanical concept of work is inadequate when one deals with the output of muscular work as measured by accomplishment, because such factors as muscular efficiency, incentive, staleness and feeling tone are concerned. It is also inadequate when the product of the work arises chiefly from mental processes. Mental effort such as addition and multiplication produces only a small increase in metabolic rate. Finally, the state of mind and the state of nutrition and health of the worker are immutably linked with performance. The work of man cannot be reduced to a simple formula.

Maximal work is defined as that which yields an average metabolic rate of eight or more times the basal metabolic rate. (The basal metabolic rate is 1,600-1,800 calories.) For short periods muscular work may be done at a rate which increases the metabolic rate twenty times above the basal rate. Maximal work is frequently performed in sports or in the laboratory; it is rarely required in industry.

Heavy work is arbitrarily defined as that amount which yields a mean metabolic rate of from three to eight times the basal metabolic rate. It has been suggested that an average of eight times the basal metabolic rate is as much as can be maintained for eight hours.

Heavy work performed over an eight hour period requires for maintenance a diet containing from 3,500 to 5,000 calories, or from 1,800 to 4,800 calories in addition to the basal requirements. Powerful men working longer hours require even a greater allowance, up to 6,000 calories above the basal requirement.

Moderate work is arbitrarily defined as that amount which yields a mean metabolic rate of less than three times the basal metabolic rate. There is little or no drain on reserve muscular energy. The increase in oxygen consumption, in heart rate and in blood pressure and the changes in the blood are slight. Most of the labor performed in the modern factory and office is of this sort.

Our knowledge regarding one of the most important aspects of work, namely the time required for and the factors concerned in recuperation, is very meager. It is the most neglected aspect of work, both muscular and mental.

Some evidence indicates that an athlete after ten seconds of maximal exertion may not be fully recuperated in one hour. The trainer believes that after an athletic exertion recuperation is incomplete in twenty-four hours. It is believed that a runner cannot do his best daily, and some believe not even weekly. In hand ergographic tests in which small muscle groups are used and the work is carried to exhaustion, the average recovery in a group of subjects is 90 per cent complete in ten minutes and 95 per cent in twenty minutes.

In regard to recuperation from the emotional strain associated with certain types of work, practically nothing is definitely known.

Some of the more important observations made by the British during the first world war and in this war may be summarized as follows:

1. An extension of the usual hours, except for a short period, does not yield a proportional increase in output.

2. After an extended period of overtime has been discontinued, weeks are required before the original steady output is attained.

3. More than sixty hours a week leads to increased lost time during work, increased absenteeism and sickness. One day's rest in seven is essential. British experience has shown fifty-six hours a week to be the optimum standard for men.

4. Organized or enforced rest periods, particularly with an opportunity to take food during the period, assist in the maintenance of a high output level.

No studies have been made to the author's knowledge of the effect of short vacations on productivity. An editorial in the *Engineer* points out that even in the days of serfdom the overlords recognized that monotony is "soul destroying and the breeder of trouble" and that a period of relaxation is something that the laborer can look forward to with pleasurable anticipation. A short vacation may possibly be the solution to the problem of staleness.

The Value of Physical Methods in the Treatment of Injuries of the Peripheral Nerves

W. Rowley Bristow, M.B., B.S. (Lond.), F.R.C.S. In Brit. J. Phys. Med., 5:1:2, January 1942.

So far as is known no form of physical treatment affects the rate or the degree of regeneration in the nerve. The aim of treatment is to conserve or restore the limb in such condition that when nerve regeneration occurs function may be recovered.

We can conveniently consider treatment under two headings:

1. *Treatment by posture,* i.e, by splints and appliances;

(a) To avoid deformity, which may arise from contracture brought about by the contraction of scar tissue, by the pull of the nonparalyzed opponents of the paralyzed muscles, or by the action of gravity;

(b) To assist recovery, it being borne in mind that a paralyzed muscle, even potentially recoverable, must be kept relaxed by approximating its origin and insertion.

2. *Treatment directed to the improved nutrition of the limb.*

Under this heading must be discussed the uses of

Heat in its various forms—radiant heat, infra red, paraffin wax baths, the eau-courant or whirlpool bath and diathermy;
Massage and mobilization;
Electrical treatment;
Exercises and muscle reeducation;
Occupational therapy.

There is considerable divergence of opinion regarding the value of treatment of paralyzed muscles by interrupted galvanism. From the physical side it is theoretically possible that stimulation of a paralyzed muscle may do actual harm, although, so far as the author is aware, in practice such evidence at present does not in any way support this purely theoretical consideration. There is as yet no uncontrovertible evidence that the paralyzed muscle improves in bulk by being made to contract by galvanic stimulation. The value of this method of treatment must be regarded as unproven when viewed from the physical standpoint, excepting in so far as it applies to joint movement. Psychologically there can be no two opinions of the value of interrupted galvanism. For a patient to see and feel his fingers and his joints move, contracting and relaxing, and controlled by his own muscles, must be most heartening and encouraging.

The whole question of occupational therapy, rehabilitation and finally vocational training has of late assumed a prominent place both on the public platform and in the medical and lay press. During the war of 1914-18, under the leadership of Sir Robert Jones, and with the financial backing of the British Red Cross Society, the whole problem was tackled and solved. The curative workshops in which all forms of occupational therapy, both light and heavy, were practiced, were an essential part of the organization of the orthopedic centers, and in these shops the men were occupied, employed and trained. The work was in part curative, in part diversional. It must be remembered that patients were kept in these centers until they were fit to return to the service, or to civil employment, always excepting those so crippled that they could not take any further part in employment, e.g., the paraplegics. Those of us who worked in the orthopedic centers appreciated their value, and it is good to see that the lessons then learned are not wholly lost, and that the profession is alive to the possibilities and advantages to be gained by the readoption of this pattern.

The soldier, and to some extent the civilian who is an air raid casualty, suffering from peripheral nerve lesions, finds the time in hospital hanging heavily on their hands; an inspection by the house surgeon and a visit to the physical treatment department do not fill in the day. Such patients should be put to work on a schedule designed not only to occupy their time, but also in many instances to assist in the cure of their disabilities and to strengthen weak limbs, to free stiff joints and to restore confidence in their power to work.

A great deal of time and study is being given to the whole question of occupational therapy, which is just as necessary for any long-stay patient detained in hospital from whatever cause, as for the conditions with which we are here concerned. The responsibility ultimately rests on the medical officer who has the care of the patient, and I believe that the massage world, under the guidance of the C.S.M.M.G., should include within their scope the detailed carrying-out of occupational therapy. It is part and parcel of the physical methods with which we are dealing in an effort to restore function. It should be part of the exercise program and should bear a definite relationship to the individual exercises which the patient is doing.

Calcareous Tendinitis in the Metacarpophalangeal Region

William Cooper, M. D., New York, N. Y. From the Hospital for the Ruptured and Crippled, New York. In J. Bone and Joint Surg., 24:1:114, January 1942.

1. These eight cases of calcification in the metacarpophalangeal region of the hand have characteristic symptoms and findings, and seem to fall into the general class of calcareous tendinitis. There are other sites of calcification in the hand. That which occurs at the pisiform, probably in the tendon of the flexor carpi ulnaris, seems to be the most frequent. The essential characteristics of this condition are the same.

2. The calcium deposits in these and other cases of calcareous tendinitis had undoubtedly been present long before the development of symptoms. The mechanism which precipitates the acute symptoms, as well as the general etiology, remains entirely obscure. All the work which has been done has shed but little light on these phases of the subject. There exists almost as many hypotheses as writers. Infection and trauma are mentioned most frequently as possibilities. An interesting, and possibly significant etiological suggestion found in this study, is that the symptoms in every instance occurred in the right hand. Bearing in mind that the mathematical possibility of this occurring in eight consecutive cases by coincidence, alone, represents one chance in 256, the author is led to believe that the additional trauma of use, to the right hand, in right-handed, middle-aged patients, might be an important factor. By the same token, trauma might well be the important etiological factor in the other locations as well.

3. Treatment of these cases consisted in immobilization in a plaster-of-Paris cast or splint, extending to the finger tips. This gave almost immediate comfort, and was retained for from five to seven days. During this period, the acute pain and swelling subsided in every case. Slight to moderate residual tenderness persisted for about two or three weeks and was treated with physical therapy in the form of diathermy through the clasped hands. In two cases exploration was done with a needle, and a small mass of creamy calcific deposit was aspirated. There was no alteration in the course of symptoms in these two patients. The calcific deposits appearing on the roentgenograms grew rapidly less prominent, and at the end of a month were very small or absent in every case.

The Knott Technic of Ultraviolet Blood Irradiation in Acute Pyogenic Infections

A Study of 103 Cases with Clinical Observations on the Effects of a New Therapeutic Agent

George Miley, M. D., D. Sc. (Med.), Philadelphia. In N. Y. State J. Med., 42:1:38, January 1, 1942.

The irradiation of blood with ultraviolet energy with a hemo-irradiator is made possible by a combination of three devices: (1) a modified Knott irradiation chamber, (2) an automatic transfusion pump, and (3) a water-cooled mercury-quartz burner.

The automatic transfusion pump allows blood to be pumped by propulsion through rubber tubing and through the Knott chamber at whatever rate is desired, thus carefully controlling the time of exposure to ultraviolet energy of each cubic centimeter of blood as it passes through the chamber. An intermittent exposure is obtained by a rotating shutter interposed between the irradiation chamber and the mercury burner.

The water-cooled type of mercury-quartz burner is used and is fastened approximately 1 cm. from the quartz window of the irradiation chamber through which the blood is pumped.

The clinical application of this combination consists of withdrawing a predetermined amount of venous blood from an individual, citrating it (one part 2.5 per cent sodium citrate to five parts blood) and immediately returning it to the same individual through the hemo-irradiator to the vein from which it was withdrawn. The immediate return to the venous circulation of irradiated blood through a closed system obviates the rapid loss from irradiated blood of ultraviolet energy, which occurs if blood is, for example, spread out in open flat receptacles during irradiation.

In using this method it is necessary to be sure that three important factors are kept constant. These are: (1) the amount of blood withdrawn and irradiated, (2) the time of exposure to ultraviolet energy, and (3) the intensity and the wavelength of the spectral energy used.

During this work several rather outstanding clinical events were noted. These may best be summarized as follows:

The bactericidal effect has been noted throughout this work. A complete disappearance of the invading bacterial organism was found to occur in cases of Staphylococcus aureus septicemia and in cases of subacute bacterial endocarditis.

The detoxification effect, to me, has been the most striking of all effects observed in cases of acute pyogenic infection following ultraviolet blood irradation therapy. There occurs in these cases almost uniformly, twelve to seventy-two hours following this therapy, a pronounced subsidence of toxic symtoms, such as nausea, vomiting, delirium, fever, general malaise, rapid pulse, rapid respiration, etc. In this connection the author has observed that there often occurs a marked fall in abnormally high temperatures. If, however, abscess formation is present or occurring, the abnormally high temperature will drop to a level slightly above normal; in such cases all toxic symptoms usually disappear and the elevated temperature drops to normal upon drainage of the abscess.

Grossly discernible peripheral vasodilation has been observed in over 75 per cent of all individuals given ultraviolet blood irradiation therapy.

Photosensitization and photodynamic effects have been carefully considered in this work, although there is neither time nor space here to present these studies. We have made a few fundamental observations regarding the combined use of chemotherapeutic agents, especially sulfanilamide derivatives, quinine, and iodides with ultraviolet blood irradiation therapy. These are, briefly: (a) Ultraviolet blood irradiation therapy can be given safely and with impunity following the administration of sulfanilamide derivatives, quinine, and iodides; however, those patients who have not received "sulfa" drugs prior to blood irradiation have a much shorter convalescent period. (b) Sulfanilamide, sulfapyridine, and iodides cannot be given safely within the first five days following ultraviolet blood irradiation therapy without risking a probable photosensitive reaction in the form of markedly increased toxemia, pulmonary edema, and renal shutdown. In the one case of photodynamic action observed with sulfathiazole (given seven days after ultraviolet blood irradiation therapy) marked convulsions were seen; no serious effects have been seen with the administration of quinine in the first few days following this therapy.

The ability of ultraviolet irradiated blood to absorb oxygen has been studied by the author and in this work it was found that in patients with abnormally low venous oxygen values following ultraviolet blood irradiation therapy there was a marked increase in the uptake of oxygen as shown by a definite rise toward normal of venous oxygen values.

A complete absence of deleterious effects has been noted in this work with acute pyogenic infections. Earlier this year Miley reported that in individuals with initially normal red cell, white cell, and hemoglobin values there was observed to be little, if any, change one to thirty-six months following ultraviolet blood irradiation therapy carried out strictly in accordance with the technic and dosage described above. Similarly, we may add that in patients receiving blood irradiation for acute pyogenic infection and having abnormal hemoglobin, red cell, and white cell values before treatment all these disappear, changing to normal following hemo-irradiation. We have been unable to find delayed harmful effects of any nature in over 1,000 applications of the Knott technic of ultraviolet blood irradiation.

Miley reaches the following conclusions:

1. The Knott technic of irradiating blood with ultraviolet must be considered, in view of the various physiologic effects it produces, a method of applying ultraviolet energy intravenously.

2. This method has been found to be valuable for

controlling acute pyogenic infections rapidly and efficiently.

3. The technic described is essentially a hospital procedure, at present. It requires careful training in its use and when properly administered is without harmful after-effects.

4. Experience with the Knott technic of irradiating blood has convinced us that it offers more to the patient suffering from acute pyogenic infection than any other therapy yet known.

The Effect of Lowered Temperatures Upon the Growth of the Fibroblast in Vitro: Its Application to Wound Healing

Machteld E. Sano, M. D., and Lawrence W. Smith, M. D., Philadelphia. In J. Labor. and Clinical Med., 27:4:460, January 1942.

There is a direct proportional relationship not only between the temperature and the rate of cell growth but also in respect to temperature and the size of the cell, its degree of differentiation, its metabolic activity and its resistance to environmental circumstance. On the basis of these studies a temperature range of 25 to 30 C. would seem to be optimal in respect to wound healing. Under such circumstances one logically might expect that the healing process would be somewhat slower than at body temperature but that the amount of collagen production, with its subsequent ugly contraction and scar formation, would be reduced appreciably.

That this optimal reaction actually does occur clinically was shown by Smith and Fay incidentally in their early studies concerning the effect of hypothermy on cancer cell growth. In one case, especially, of extensive ulcerative breast carcinoma treated by continuous local hypothermy for nearly six months, not only did the tumor disappear but the ulcerated surface healed over completely with soft scar tissue having the consistency of normal skin.

On the basis of such clinical observations and the confirmatory laboratory evidence of the behavior of the fibroblast at these lower temperatures, the more widespread use of hypothermy in wound healing would seem to be warranted. Its application in plastic surgery, of the cosmetic type particularly, comes to mind immediately. The possible prevention of keloid formation is another field which might profitably be explored. Its place in clearing up old osteomyelitis lesions likewise might be investigated.

In our own studies the reduction of temperature to 25 or 30 C. gives us similar optimal conditions for satisfactory wound healing. The cells are growing vigorously; they are closely packed and the circulation is slowed. Thus the products of metabolism are in close contact with the cells, and remain so, through the inability of the slowed blood stream to carry them away. In addition these temperatures are bacteriostatic to a very considerable degree and aid materially in checking any infection which might be present.

Calcification and Ossification:

III. The Role of Local Transfer of Bone Salt in the Calcification of the Fracture Callus

Marshall R. Urist, M. S., M. D., Baltimore, Md. From Johns Hopkins Medical School, Baltimore, Md. In J. Bone and Joint Surg., 24:1:47, January 1942.

1. Spontaneous calcification of the rachitic callus in the later stages of healing has been described in detail and has been shown to be responsible for the consolidation of fracture in rickets.

2. Spontaneous calcification of the callus has been defined, on the basis of observations upon the blood calcium and phosphorus, and upon undecalcified histological specimens which demonstrate the bone salt, as calcification which is progressive and limited to the fracture area. It is not accompanied by any change in the levels of the blood calcium and phosphorus, or in the existing state of the rachitic metaphyses. The calcium salts are laid down in the osteoid and cartilage of the tissues adjacent to the shaft in a characteristic pattern which is clearly distinguishable from calcification which follows administration of phosphate solution or vitamin D, and results in healing of the rickets.

3. The necrotic and uninjured portions of the section of the shaft which is enclosed in the growing callus have each been considered as possible sources of the calcium salts deposited in spontaneous calcification of the callus. The fact that the living cortical bone, by far the greatest portion of the length of the shaft enveloped in callus, becomes considerably rarefied when the callus reaches maximum size, and at the time when spontaneous calcification reaches its maximum distribution, suggests that this calcification represents local transfer of calcium salts from the shaft to the callus. Since the necrotic portion of the section of the shaft surrounded by callus is only a small fraction of the bone mineral stored in the cortex at the fracture area, it is believed that if it contributes to local transfer in the course of its absorption, the amount of bone salt thus liberated is relatively insignificant and cannot be regarded as an important source of the calcium salts deposited in the callus of healing fractures.

4. Because local implantations of devitalized bone or injections of colloidal calcium phosphate into the rachitic callus osteoid, prior to the advent of spontaneous calcification, fail to initiate calcification, it is concluded that these substances cannot be regarded as local sources of the bone salt. The differences in the mechanism of the resorption of living bone, as compared with the process of the absorption of dead bone or calcium salts, suggest that the local redistribution of the bone salts in the area of a healing fracture is brought about by the activity of the cellular elements of the bone, possibly the osteoclasts.

5. The phenomenon of local transfer of calcium

salt may be regarded as indirect experimental evidence of local increase in concentration of dissolved calcium salt in the extracellular fluid of living bone undergoing resorption.

The role of local transfer of calcium salt from shaft to new bone in the healing of fractures is considered that of a reserve mechanism which aids in consolidating callus under conditions adverse to calcification of the skeleton in genera. The humoral source of bone salt is essential for the normal progress of healing, and cannot be entirely replaced by local sources of mineral without considerable delay in the uniting of fractures. Resorption of cortical bone, the process leading to local transfer of bone salt, does not appear until the later stages of healing, does not progress at a rate parallel to osteogenesis, and fails to supply the quantity of mineral needed to calcify the existing callus at any one time. Bone salt originating locally in necrotic bone or implanted in the callus is absorbed without influence upon the progress of calcification of the new bone and cartilage matrix.

The results of therapy in tubo-ovarian infections while often good were not sufficiently good to warrant routine use of this method of treatment. It would seem that one cannot hope for resolution of old inflammatory tubo-ovarian masses since fibrosis and multilocular cysts are a prominent part of the pathological condition. It may, however, be given a trial in persistent tubo-ovarian infections which do not respond to other methods of treatment as well as in those patients in whom operative treatment is not indicated.

The best response to the therapy was noted in cases of massive cellulitic infection of recent origin which failed to yield to ordinary treatment. Pelvic iontophoresis is recommended in particular for this type of infection.

The preoperative preparation of myomas associated with pelvic inflammatory disease may often be shortened with this method and the operative risk decreased.

The Sympathetic Nervous System: Influence on Sensibility to Heat and Cold and to Certain Types of Pain

Olan R. Hyndman, M. D., and Julius Wolkin, M. D., Iowa City. In Arch. Neurology and Psychiatry, 46:6:1006, December 1941.

In a previous communication we called attention to the fact that the sensation from a sympathectomized zone of skin when exposed to cold differs considerably from that of a normally innervated zone. Seven patients were nude except for a loin cloth. They remained in the refrigerator from thirty to sixty minutes while studies of cutaneous temperature were carried out. Three patients had had a unilateral cervicodorsal ganglionectomy (removal of the inferior cervical and upper two dorsal ganglia). One had had unilateral removal of the inferior cervical and upper six dorsal ganglia. Two patients had had a unilateral splanchnicotomy and removal of the first and second lumbar ganglia. One patient had had bilateral removal of the second, third and fourth lumbar ganglia.

These patients volunteered the information that the sympathectomized zone did not feel the same as the opposite side or the remainder of the body. The difference was in relation to the sensation of cold and to the aching and stinging pain which results from exposure to cold.

Evidence is presented to show that a sympathectomy has a pronounced influence on the interpretation of high and low temperatures when the sympathectomized part is compared simultaneously with a normally innervated part. A cold object feels warmer and a hot object feels cooler to the sympathectomized hand than to its normal mate. When a sympathectomized zone of the skin is tested alone no alteration can be elicited in the sensibility to or the discrimination of touch, pain and temperature as compared with these faculties on the normal side.

A sympathectomy diminishes, and almost abolishes, the aching and stinging pain in the hand and foot that results from exposure to severe cold.

We believe that our results have greater significance than merely that related to a change in cutaneous temperature occasioned by sympathectomy.

No attempt is made to prove whether such changes are contingent on the interruption of sympathetic afferent or sympathetic efferent fibers. However, two cases are presented in which the lower extremities were supplied by sympathetic fibers but were devoid of somatic innervation. Sensation could be evoked by appropriate stimuli.

Conclusion

A sympathectomy (1) alters the interpretation of temperature when a sympathectomized area is compared simultaneously with a normally innervated part and (2) greatly diminishes the aching and stinging pain of the hands and feet that results from exposure to severe cold.

A Test for Median Nerve Function

Robert Wartenberg, M. D., San Francisco, Calif. In Surg., Gynec. and Obst., 73:6:872, December 1941.

Our test for a median nerve lesion is performed as follows: The patient is asked to stretch the thumbs of both hands as much as possible, keeping them on a plane with the palm while the other fingers remain adducted. He then is instructed to lift his hands in front of him, as in the position of Oriental prayer, the palms facing the examiner. In this position the radial tips of the indices touch each other at a horizontal level; so do likewise the tips of both thumbs if there is no lesion of the median nerve. If, however, a median nerve lesion is present, the tip of the thumb of the affected side does not extend horizontally to the tip of the other thumb but instead touches the inner ulnar aspect of the healthy thumb proximal to the tip. The more severe the median nerve palsy is, the more proximally the tip of the affected thumb touches the healthy thumb. A subsiding median nerve palsy is characterized by

the ability of the patient to reach more nearly the tip of the healthy thumb with the tip of the affected one. One of my patients who had occupational pressure neuritis of the right median nerve discovered this for himself, and at succeeding monthly visits showed me triumphantly how he could more and more nearly reach the tip of the healthy thumb with the tip of the affected one.

Book Reviews

MENTAL DISEASE AND SOCIAL WELFARE. By Horatio M. Pollock, Director of Mental Hygiene Statistics, New York State Department of Mental Health. Cloth, Price, $2. Pp. 237. Utica: State Hospitals Press, 1941.

The high incidence of mental disease in the United States is such as to be of special interest for the sociologist as well as the physician. The relationship between the occurrence of neuroses and psychoses and the degree of so-called civilization has long been recognized. Economic, social and environmental factors are part of the community welfare as well as the welfare of the individual. The present book is an analysis of the social significance of mental disease. The author has collected significant statistics of the incidence of the more common disorders and has stressed the role of social welfare in dealing with this problem. Newer methods of early recognition and treatment are being utilized in an effort to improve prevailing shortcomings.

The author is a well recognized authority and his findings and interpretations are well worth careful study.

PROBLEMS OF PSYCHOANALYTIC TECHNIQUE. By Otto Fenichel. Translated by David Brunswick. Paper. Price, $1.50. Pp. 130. Albany: The Psychoanalytic Quarterly, Inc., 1941.

The use of psychoanalysis in the understanding and treatment of mental disorders has been gaining momentum in this country. Although the general principles of this psychiatric approach are commonly known and are a result of the writings of Freud and others, the technic for its successful application requires individual study.

In this monograph the author permits the reader to peruse some of the leading approaches to the understanding of the subconscious and presents some of the guiding principles in this form of therapy. It is well written and is worth reading.

AMERICA'S NUTRITION PRIMER. WHAT TO EAT AND WHY. By Eleanora Sense. Introduction by Dr. E. V. McCollum, Johns Hopkins University. Cloth. Price, $1. Pp. 95. New York: M. Barrows and Company, 1941.

Every physical therapist is frequently asked about diet, vitamins, and many other questions on what to eat and why. Nutrition has become a science which includes many highly technical subjects. Here is a book which can be recommended as a guide to women who have not the time to study the subject of nutrition in its technical aspects.

There is an increasing emphasis on the importance of right eating for the preservation of health. We can agree with Doctor McCollum when he states in his introduction: "Our success in applying nutritional science to improving individual health will depend largely upon the extent to which women avail themselves of just such guidebooks as this one."

ARTHRITIS IN MODERN PRACTICE: THE DIAGNOSIS AND MANAGEMENT OF RHEUMATIC AND ALLIED CONDITIONS. By Otto Steinbrocker, B.S., M.D., Assistant Attending Physician and Chief, Arthritis Clinic, Bellevue Hospital, Fourth Medical Division, New York City. With chapters on Painful Feet, Posture and Exercises, Splints and Supports, Manipulative Treatment and Operations and Surgical Procedures. By John G. Kuhns, A.B., M.D., F.A.C.S., Chief of the Orthopedic and Surgical Service, Robert Breck Brigham Hospital, Boston. Cloth. Price, $8. Pp. 606, with 321 illustrations. Philadelphia and London: W. B. Saunders Company, 1941.

The National Health Survey made in 1935-36 by the U. S. Public Health Service revealed that some 6,850,000 or 5 per cent of our population suffer from some form of rheumatic disease. In this survey the rheumatic disorders, excepting only nervous and mental disorders, led the various chronic and incapacitating diseases in the duration of disability and in the amount of invalidism. With these figures in mind every new approach to the study of this disease must be of value. In this most recent monograph on arthritis the author has incorporated the latest information on the diagnosis and treatment of rheumatic disease in a concise and practical form. Pathology and other aspects of this disease are given only such attention as practical considerations dictate, and the extensive investigations in bacteriology and immunology are of necessity mentioned only briefly.

The treatment of articular conditions in this volume is chiefly considered from the medical standpoint. But there are excellent chapters on the orthopedic aspects of treatment by Doctor Kuhns. The chapter on physical therapy in arthritis is only seven pages in length. In a book of nearly 600 pages this seems an inadequate consideration of the importance of physical agents in the treatment of this disease. Of course this chapter considers only heat, fever therapy, massage and underwater exercise, and there is an excellent chapter of 40 pages on posture and exercise by Doctor Kuhns. In this chapter there is a better consideration of underwater exercise than in the chapter labeled physical therapy. It would be advantageous to enlarge the first-mentioned chapter and combine it with the chapter on posture and exercise, as they both are physical therapy.

This is a timely book, well written and illustrated. It should prove most valuable to the general practitioner to assist him in diagnosis and management of rheumatic and allied conditions.

BODY MECHANICS IN HEALTH AND DISEASE. By Joel E. Goldthwait, M.D., F.A.C.S., LL.D., Lloyd T. Brown, M.D., F.A.C.S., Loring T. Swaim, M. D., and John C. Kuhns, M. D., F.A.C.S. With a chapter on the Heart and Circulation as Related to Body Mechanics. By William J. Kerr, M.D., F.A.C.P. Third edition. Cloth. Price, $5. Pp. 316, with 121 illustrations. Philadelphia, Montreal & London: J. B. Lippincott Company, 1941.

This volume again demonstrates that a person is in better health with the body so poised or balanced that all the organs are in their proper positions and the muscles are in proper balance. It also shows that best health could hardly be expected with a poise such that the viscera of both the abdomen and thorax are thrown out of place. This book also puts before the profession those factors which have been of the greatest help to the writers in the treatment of the chronic patient, and it indicates the lines along which a most promising study lies for the further increase of our knowledge.

These authors believe that the medical profession still has little interest in chronic medicine, but since the first edition of this book was published in 1937 the fundamental principles of body mechanics described in the study of patients suffering from chronic diseases have become increasingly important. It has been found that they apply not only to the problems of disease, but even more to the study of the healthy or near-healthy individual.

In this time of our national emergency more emphasis than before is being placed on the maintenance of physical fitness and health. These authors believe that many chronic diseases are associated with a wrong use of the body which must have begun in childhood or early adult life. This being the case it is evident that it is desirable to see that proper training of the body is given before the structures have become misshapen or displaced.

This third edition has been completely revised. There has been added an excellent chapter on the heart and circulation as related to body mechanics. This book can be recommended and should be in the library of every physical therapy technician.

UNDERSTANDING YOURSELF: THE MENTAL HYGIENE OF PERSONALITY. By Ernest R. Groves, Professor of Sociology, University of North Carolina. Cloth. Price, $2.50. Pp. 279. New York: Emerson Books, Inc., 1941.

This is another of the many books which now flood the bookstands holding forth some hope for a better understanding of one's personality. It is written primarily for the layman rather than for scientific consumption. It covers the usual items dealing with personality formation, such as the early childhood, background and experiences in life which are responsible for the adult personality.

The author tries to encourage a more wholesome attitude toward one's unavoidable maladjustments so that they may be corrected through intelligent understanding.

WHY BE SHY? HOW TO BANISH SELF-CONSCIOUSNESS AND DEVELOP CONFIDENCE. By Louis E. Bisch, A.B., M.D., Ph.D. Cloth. Price, $2. Pp. 265. New York: Simon and Schuster, 1941.

In man's struggle for existence in a difficult world, feelings of inferiority are the rule. In some individuals the "inferiority complex" may be so prominent as to interfere with the pursuit of happy and successful living. The author, well known for previous psychiatric writings for the layman, attempts to unmask this complex, explaining why people are shy and encouraging means to overcome this disturbing nuisance. Intelligent understanding and wholesome compensation can relieve this sympton complex.

THE MAN WHO LIVED FOR TOMORROW: A BIOGRAPHY OF WILLIAM HALLOCK PARK, M. D. By Wade W. Oliver. Cloth. Price, $3.75. Pp. 507, with portrait. New York: E. P. Dutton & Co., Inc., 1941.

Doctor Park was a member of the New York City Department of Health for forty-six years and his name was associated with preventive medicine and public health for almost fifty years. The author of this biography is Professor of Bacteriology at the Long Island College of Medicine. He is, therefore, qualified to write a sympathetic biography of a man who entered the service of New York Health Department as "Bacteriological Diagnostician" in 1893.

Park's name is inseparably associated with diphtheria. His early contacts with this study are most interesting. Prudden and William H. Welch were the first two Americans admitted to a month's course in bacteriology which Koch gave in Berlin in 1885. Prudden in 1887 became a Consulting Bacteriologist of the Board of Health of New York City. Prudden gave Park a scholarship which amounted to $125 every three months and this continued for two years until Park's researches had convinced Prudden that the diphtheria bacillus is the only cause of diphtheria. For the next two years, 1890-1892, Park, although he was still in practice, worked diligently upon the diphtheria problem in Prudden's laboratory. From this start he later became the director of the Bureau of Laboratories of New York's Health Department. In his work in this department he saved the lives of thousands of children by his diphtheria antitoxin.

While Doctor Park's work on diphtheria was the outstanding achievement of his life there is scarcely an area in the field of public health which has not been affected by his laboratory research. The crowning glory of all the honors conferred upon Park was the dedication of the William Hallock Park Laboratory in 1936. Dr. C. E. A. Winslow at this ceremony stated: "It would, I think, be difficult to overestimate the debt which the public health movement owes to New York City for the inspiration which has come to us from this laboratory and from Doctor Park as its leader. The New York Health Department was the pioneer in the field of diagnostic bacteriology and was the actually effective stimulus to the development of such procedures throughout the land."

WILLIAM HENRY WELCH AND THE HEROIC AGE OF AMERICAN MEDICINE. By Simon Flexner and James Thomas Flexner. Cloth. Price, $3.75. Pp. 539, with 26 illustrations. New York: The Viking Press, 1941.

This is the biography of one of the great leaders of medicine in the history of the world. He was described by President Hoover as the greatest statesman in the field of public health. Philip Welch, who began the Welch line in this country, was in 1654 kidnapped from Ireland by Cromwell's soldiers; at the age of eleven he was sold in Boston harbor for a nine year term as an indentured servant. Four years later he refused to work any longer in his master's fields unless he were paid, staging what some writers call the first strike in New England's history. This man's grandson established the family in Norfolk, Connecticut, in 1772. The father of William Henry Welch was born in 1818, and went to Yale Medical Institute. When he was graduated in 1839 he was still under twenty-one years of age.

William Henry Welch was graduated from Yale in 1870 and became a school teacher. He sought an appointment in Greek at Yale but did not get it. Welch's future now looked so empty that he listened to the proposal that he had rejected for many years to follow the family tradition and go into medicine.

The medical career of Doctor Welch is known to every physician. After his medical school studies in the United States he went to Europe to study under the men who laid the foundation of modern pathology and bacteriology. On his return to the United States he was associated with the founding of the Johns Hopkins Hospital and the Johns Hopkins University of Medicine. From here his influence and work made him one of the great leaders of the "Heroic Age of Medicine." This volume can be highly recommended as one of the best medical biographies.

WAR, POLITICS AND EMOTION. By Geoffrey Bourne. With an introduction by Dorothy Canfield Fisher. Cloth. Price, $1.25. *Pp.* 110. *New York: Liveright Publishing Corporation,* 1941.

This monograph draws analogies between politics, including war, on the one hand, and the sciences, including medicine, on the other. The author believes and shows that politics may largely be considered an art with a complacent tendency to believe that it should remain one. He states: "Politics is the only profession in which, the world over, ignorance is not a handicap, and in which emotion is an asset as compared with reason."

"But medicine, like politics, has for years been regarded as an art. The passing of years has not displaced from medicine the importance of a knowledge of human nature but they have added greatly to the number of scientific weapons used in diagnosing and treating disease. Medical knowledge has advanced with a notable absence of emotional controversy." The author attempts in this book to deal in a detached manner with the scientific basis of politics, and to place politicians in their proper perspective as men subject to the ordinary laws of psychology, physiology and pathology. Whether he succeeds in this attempt or not, the book can be recommended as interesting reading.

OBJECTIVE AND EXPERIMENTAL PSYCHIATRY. By D. Ewen Cameron, Professor of Neurology and Psychiatry, Albany Medical College; Neurologist and Psychiatrist, Albany Hospital. Cloth. Second Edition. Price, $3.75. *Pp.* 390. *The Macmillan Company,* 1941.

Most books on the subject of psychiatry stress the subjective phenomena dealing with the thinking, feeling and acting of the disturbed individual. Nevertheless it has been long recognized that many physiologic changes are associated with mental phenomena. The physiologist has worked hand in hand with the psychologist in studying the activities of the nervous system and this book summarizes much of the present-day findings of an objective nature. Electrical phenomena, metabolic activities and chemical changes are considered and correlated with the clinical syndromes. The possible role of disturbances of the autonomic nervous system in mental disorders is particularly stressed. This book should be read by all interested in the subject of nervous disorders.

TRAINING AND EFFICIENCY. (AN EXPERIMENT IN PHYSICAL AND ECONOMIC REHABILITATION.) By E. Jokl, E. H. Cluver, C. Goedvolk and T. W. de Jongh. Boards. Pp. 188, *with* 46 *illustrations. Johannesburg: The South African Institute for Medical Research,* 1941.

The first two paragraphs of the introduction to this book give the purpose of this work and are worth quoting because they represent thoughts of a country so far distant from ours. " 'Government cannot produce wealth. Only the people can produce wealth.' This statement has been made since the first scientific approaches to economics. Adam Smith made it. Napoleon made it. Disraeli and Levin made it; and quite recently Wendell Willkie took it as the leading theme of his election speeches."

"The economic crisis of our time calls for more production and for a better system of coordination and distribution. No 'New Deal,' no 'New Order,' no 'National Revolution' and no other magic mechanisms for prosperity have a chance to succeed unless they are capable of putting into practice a plan of integrated maximal production. 'Only the strong can be free; and only the productive can be strong.' "

This study is to be presented in four stages. First is an experimental survey of the basic physical efficiency of the different racial groups of South Africa. The second part presented in this volume describes the effects of a training course upon the physical efficiency of a sample of unskilled European laborers. The third part will deal with the economic significance of the educational effort described in this volume. The fourth part deals with the administrative steps.

This volume presents an elaborate study of effects of this training program on thirty-two underprivileged young men. It is of interest to every student and teacher of physical education.

DISEASES OF THE DIGESTIVE SYSTEM. Edited by Sidney A. Portis, B.S., M.D., F.A.C.P., Associate Clinical Professor of Medicine, Rush Medical College of the University of Chicago; Attending Physician, Michael Reese Hospital; Consulting Physician, Cook County Hospital, Chicago. Cloth. Price, $10. *Pp.* 952, *with* 176 *illustrations. Philadelphia: Lea & Febiger,* 1941.

This volume presents a broad knowledge of the entire field of gastroenterology. The editor is a teacher and a gastroenterologist of national reputation. There are fifty contributors and each has made a special study of that branch of the subject which he discusses.

The author recognizes that the modern gastroenterologist must be thoroughly trained in laboratory methods and have a broad general clinical experience in all branches of internal medicine. The chapters on the anatomy and the normal and abnormal physiology of the gastrointestinal tract lay a splendid foundation for a clear understanding of the diseases of the digestive system. In the discussion of these diseases special emphasis is placed on those contributory factors which produce gastrointestinal symptoms. For instance, there are chapters on neurogenic disturbances; gastrointestinal manifestations of cardiovascular disease and gastrointestinal factors in and manifestations of renal disease. At the same time it offers a full discussion of each of the diseases of the gastrointestinal tract, their diagnosis and their treatment. The general practitioner will find this an excellent reference book to aid in meeting the problems of the treatment of the diseases of the digestive system.

THE FURTHERANCE OF MEDICAL RESEARCH. By Alan Gregg, M.D., Director for the Medical Sciences at the Rockefeller Foundation. Cloth. Price, $2. *Pp.* 129. *New Haven: Yale University Press,* 1941.

This volume is based on a lecture delivered at Yale University under the Terry Foundation. The first part considers what medical research is. The second chapter deals with the institutions conducting or furthering medical research and with their relationships to each other—especially the relation between foundations and universities. In the third part the characteristics of the man who does medical research is described.

The author discusses these problems with the belief that no branch of science touches more intimately the welfare of man than medical science, and that medical psychology and psychiatry march with religion itself. Gregg believes that medical research, the sensitive growing fringe of medicine, deserves the keen attention and deliberate reflection of those who already realize that science is not the only source of happiness and welfare. "To distinguish between the rewards of religion and the benefits of science one must become familiar with the scope and the limitations of each, for nothing dispels the confusion of a falsely posed alternative or a spurious antithesis as effectively as a clear exposition of qualities and definition of boundaries." Every medical research worker should read this book.

WORKBOOK FOR PHYSICAL EDUCATION. By Mae Iddins, A.B., B.P.E., Instructor in Physical Education, Carson-Newman College, Jefferson City, Tennessee. Paper. Price, $1.50. *Pp.* 144, *with* 73 *illustrations. St. Louis: C. V. Mosby Company,* 1941.

This book gives a brief introduction to various sports and is intended for women students. It enables each student to make a study of the sports so that she may be capable of selecting a form of activity which will meet her needs for exercise and also her ability for developing skills while she is a student.

The sports are arranged in this book to meet the needs of the physical education program in schools or colleges, and they are presented according to the sports suited for different seasons. It can be recommended to students of physical education in colleges and to recreational directors.

Convention Calendar

Date	Organization	Place
Mar. 30-Apr. 1, 1942	California Association of Health, Physical Education and Recreation	Sacramento, Calif.
April 13-16	Western Hospital Association (Physical Therapy Section, Wash., Ore., N. Calif., and S. Calif. Chapters, American Physio. Assoc.)	Seattle, Wash.
April 1-4	Central District Health and Physical Education Association	Des Moines, Iowa
April 9-11	Southwest Association of Health, Physical Education and Recreation	Albuquerque, N. Mex.
April 14-16	Tennessee State Medical Society	Memphis, Tenn.
April 15-17	Iowa State Medical Association	Des Moines, Iowa
	Hospital Association of Pennsylvania	Pittsburgh, Penna.
	Pennsylvania Physiotherapy Association	Pittsburgh, Penna.

April 15-18	American Association of Health, Physical Education and Recreation	New Orleans, La.
April 20-22	New Jersey State Nurses Association	Atlantic City N. J.
	State League of Nursing Education	Atlantic City N. J.
April 22	New Jersey State Organization for Public Health Nursing	Atlantic City N. J.
April 27-29	Missouri State Medical Association	Kansas City Mo.
May 2, 1942	Ohio State Association of Handicapped	Youngstown, Ohio
May 4-7, 1942	California State Medical Association	Del Monte, Calif.
May 5-6 1942	Association of American Physicians	Atlantic City, N. J.
May 10-16, 1942	American Association of Medical Social Workers	New Orleans, La.
May 14-16, 1942	American Academy of Pediatrics (Regional)	Cleveland, Ohio
May 17-22, 1942	American Nurses Association	Chicago, Illinois
May 17-22, 1942	Public Health Nurses Association	Chicago, Illinois
June 8-12, 1942	American Medical Association	Atlantic City, N. J.
June 1942	Connecticut State Medical Association	Middletown, Conn.
June 1942	American Association of Health, Physical Education and and Recreation	New Orleans, La.

Chapter Directory

Carolina Chapter

President, Mary E. Haskell, North Carolina Orthopedic Hospital, Gastonia, N. C.
Secretary, Olena M. Cole, Station Hospital, Fort Bragg, N. C.

Central New York Chapter

President, Mrs. Thelma Curley, Percy Hughes School, Jamesville Ave., Syracuse, N. Y.
Secretary, Mrs. M. Stell Murphy, 219 Genesee St., Utica, N. Y.

Colorado Chapter

President, Esther Wilcox, 1307 Franklin, Denver, Colo.
Secretary, Mrs. Alice Swanson, 1254 St. Paul, Denver, Colo.

Connecticut Chapter

President, John O,Donnell, Yale University, Dept. of Health, New Haven, Conn.
Secretary, Mildred V. Grillo, 29 French Town Road, Bridgeport, Conn.

District of Columbia Chapter

President, Ruth Preston, Walter Reed Gen. Hospital, Washington, D. C.
Secretary, Esther Anderson, Walter Reed Gen. Hospital, Washington, D. C.

Eastern New York Chapter

President, Marguerite Stillman, 17 Dove St., Albany, N.Y.
Secretary, Grace L. Berry, 124 Rosa Road Schenectady, N.Y.

Georgia Chapter

President, Mrs. H. J. Price, Emory University, Ga.
Secretary, Alice Lou Plastridge, Warm Springs Found., Warm Springs, Ga.

Illinois Chapter

President, Mrs. Louise A. Chase, 3802 N. Avers Ave., Chicago, Ill.
Secretary, Victoria Vacha, 7139 S. Bennett Ave., Chicago, Ill.

Indiana Chapter

President, Adelaide L. McGarrett, 4505 Marcy Lane, Indianapolis, Ind.
Secretary, Ethel C. Scofield, James E. Roberts School, Indianapolis, Ind.

Iowa Chapter

President, Loraine Frost, 15 W. Davenport Street, Iowa City, Iowa.
Secretary, Doris Spicer, 118½ S. Dubuque, Street, Iowa City, Iowa.

Louisiana Chapter

President, Mrs. Marion B. Stewart, 5421 St. Charles Ave., New Orleans, La.
Secretary, Ruth Langley, 1210 Peniston Street, New Orleans, La.

Maine Chapter

President, Florence Orr, 489 State St., Bangor, Me.
Secretary, Lillian Shotter, Vet. Adm. Fac., Togus, Me.

Maryland Chapter

President, Jane Ewing, Kernan Hospital, Baltimore, Md.
Secretary, Edith Nyman, 719 Broadway, Baltimore, Md.

Massachusetts Physiotherapy Association, Inc.

President, Catherine P. Warren, 688 Boston Post Rd., Weston, Mass.
Secretary, Frances S. Turtle, 8 Newport Rd., Cambridge, Mass.

Michigan Chapter

President, Norma Graham, 25 E. Palmer Ave., Detroit, Mich.
Secretary, Eleanor Parmalee, 464 Maplehurst Ave., Ferndale, Mich.

Minnesota Chapter

President, Georgia May Schori, Shriners Hospital, Minneapolis, Minn.
Secretary, Lillian Hubmer, 2515 Nicollet Ave., Minneapolis, Minn.

Missouri Chapter

President, Blanche Marvin, St. Joseph's Hospital, Kansas City, Mo.
Secretary, Margaret E. Wiley, 1307 S. Noland Rd., Independence, Mo.

New Jersey Chapter

President, Mary P. Sweeney, St. Barnabas Hospital, Newark, N. J.
Secretary, Laurel Moore, 176 Woodland Ave., Verona, N. J.

New York Chapter

President, A. Garman Dingwall, 191 Claremont Ave., New York, N. Y.
Secretary, Margit Aden, 1045 Park Ave., New York, N. Y.

Northern California Chapter

President, Florence C. Burrell, 230 Grand Ave., Oakland, Calif.
Secretary, Virginia Dare Utz, 1624 Franklin St., Oakland, Calif.

Ohio Chapter

President, Mrs. Mary L. Deatherage, 513 Malvern Road, Akron, O.
Secretary, Mildred F. Heap, Vanderbilt Univ. Hospital, Nashville, Tenn.

Oregon Chapter

President, Jennie Hunter, 4005 S. E. Stark, Portland, Oregon.
Secretary, Hazel G. Hardy, 574 N. Lombard, Portland, Ore.

Pennsylvania Physiotherapy Association, Inc.

President, Mr. S. Paul Campbell, 2523 Mansfield Ave., Drexel Hill, Pa.
Secretary, Mrs. Helen Fidler Kenney, 313 S. Smedley St., Philadelphia, Pa.

Rhode Island Chapter

President, Elinor Sherman, Rhode Island Hospital, Providence, R. I.
Secretary, Isabelle O'Hern, 81 Sumter St., Providence, R.I.

Santa Barbara Chapter

President, Virginia Horsley, 1129 E. Meta St., Ventura, Calif.
Secretary, Helen Bunclark, 1421 State St., Santa Barbara, Calif.

Southern California Chapter

President, Bess D. Bernhard, 2424 S. Flower St. Los Angeles, Calif.
Secretary, Barbara Schaufelberger, 2946 W. Ave. 33, Los Angeles, Calif.

Territory of Hawaii Chapter

President, Mrs. Barbara N. Campbell, Shriner's Hospital, Honolulu, T. H.
Secretary, Barbara White, Queen's Hospital, Honolulu, T. H.

Texas Chapter

President, Kathryn F. Brown, John Sealy Hospital, Galveston, Texas.
Secretary, Verna Mae Schuster, Memorial Hospital, Houston, Texas.

Virginia Chapter

President, Alice N. Jones, 318 W. Franklin St., Richmond, Va.
Secretary, Elsa M. Lange, 1536 West Avenue, Richmond, Va.

Washington Chapter

President, Mrs. Miriam M. Madison, 6652 E. Greenlake Way, Seattle, Wash.
Secretary, Helen C. Anderson, 1221 Taylor Avenue, Seattle, Wash.

Western Michigan Chapter

President, Elizabeth Murphy, Ann J. Kellogg School, Battle Creek, Mich.
Secretary, Evelyn Tinkham, 330 Eastern Ave. S. E., Grand Rapids, Mich.

Western New York Chapter

President, Mrs. Gertrude Schaffer, 880 Lafayette Ave., Buffalo, N. Y.
Secretary, Mrs. Mary Jones, 125 Riverside Ave., Buffalo, N.Y.

Wisconsin Chapter

President, Fae Henry, 1418 Virginia Ave., Sheboygan, Wisc.
Secretary, Lelia Hoaglin, 916 New York Ave., Sheboygan, Wisc.

PHYSICAL THERAPY

This concise reference text on history contains information formerly unavailable within the scope of a single volume. It discusses:

I. Physical Therapy from Ancient Times to the Renaissance.
II. Massage and Exercise.
III. Water.
IV. Electricity.
V. Radiant Energy.

By John S. Coulter, M. D., Assistant Professor of Physical Therapy, Northwestern University Medical School, Chicago.

No. 8, Clio Medica: A Series of Primers on the History of Medicine, Published by Paul B. Hoeber, Inc. Cloth. Pp. 142, with 15 illustrations. Price $1.50.

This book may be purchased through the Business Office of

The Physiotherapy Review, 737 N. Michigan Ave., Chicago, Ill.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

PHYSICAL THERAPY COURSE

Under the direction of John S. Coulter, M. D., Associate Professor of Physical Therapy, and Miss Gertrude Beard, R. N.

EMERGENCY COURSES FOR DEFENSE PROGRAM, opening July 1, 1942. Open to a limited number of graduates of accredited schools of nursing and physical education. Thorough courses are given in the fundamental subjects. Credit toward a degree is granted in the School of Education of Northwestern University.

For application blank and further information address

DEAN OF NORTHWESTERN UNIVERSITY MEDICAL SCHOOL
303 East Chicago Ave., Chicago, Ill.

BOSTON UNIVERSITY
SARGENT COLLEGE OF PHYSICAL EDUCATION
TWO-YEAR COURSE IN PHYSICAL THERAPY
Given with the Cooperation of the B. U. School of Medicine

This course is open to students who have satisfactorily completed the first two years at the college, or the equivalent. Thorough professional training is given in fundamental subjects and practice in physical therapy technique in Boston hospitals. The course leads to the degree of Bachelor of Science in Physical Education, with a certificate in physical therapy. The college is on the certified list of the American Physiotherapy Association and on that of the American Medical Association.

For further information, address Nelson S. Walke, Ph. D., Dean
32 Everett Street
CAMBRIDGE, MASSACHUSETTS

Annual Convention 1942

★ ★

June 28, 29, 30,

July 1, 2 and 3

★ ★

College Camp, Williams Bay
on Lake Geneva, Wisconsin